HEATING AND VENTILATING

MARCH 1930

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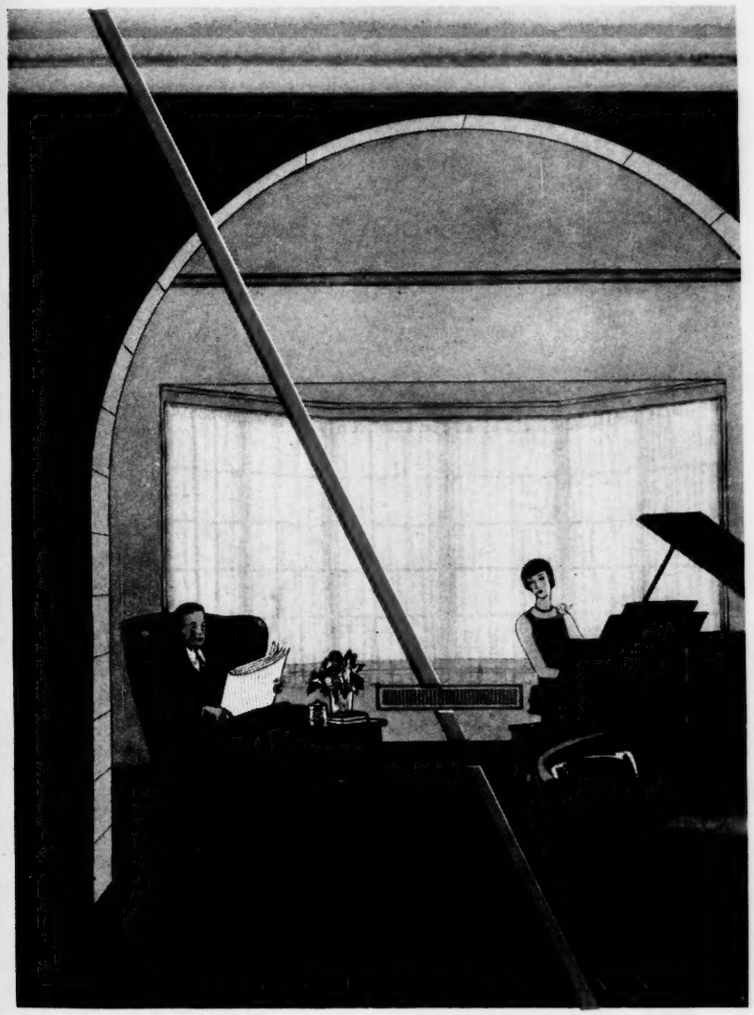
MODERN



FROM the heating contractor's viewpoint the development of Concealed Copper Radiation by Modine is the most important improvement in years.

Made by the manufacturers of Modine Unit Heaters, contractors are assured of the dependability of this product. Hundreds of completely satisfactory installations provide evidence of the rugged construction, and the dependable performance of this new radiation.

Modine Concealed Copper Radiation has created a new interest in heating. It makes the heating contractor a more important factor in the building program. Brings him in at earlier stages in construction — even before lathers and plasterers. Spreads his busy season over a longer period. Enables him to do more work with the same force. His profits are not eaten up in handling and trucking costs.

Architects and home builders everywhere are endorsing Modine Concealed Radiation. It will pay you to have full information, to be able to quote installation costs. Let us give you all the facts now.

MODINE MANUFACTURING COMPANY

Manufacturers of

Automotive Radiators, Concealed Copper Radiation, Unit Heaters

1707 RACINE STREET RACINE, WISCONSIN

Branch Offices in all large cities

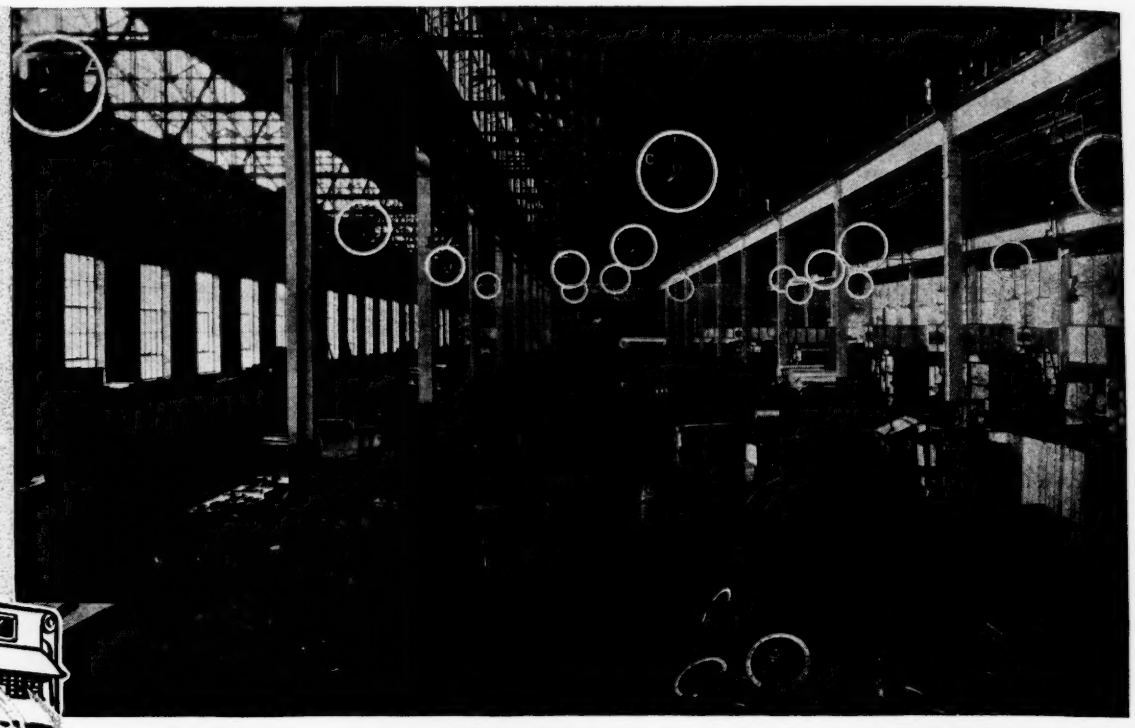
London Office: S. G. Leach & Co. Ltd., 26-30 Artillery Lane.

Copyright 1930, Modine Mfg. Co.

MODINE

COPPER RADIATION

A MODINE Product



A typical installation of McQuay Unit Heaters. If old-style heating methods were used here, most of the heat would be wasted up near the roof.

All Copper Heating Element

Tubes of the heating element are of heavy gauge copper, welded into a copper header—giving equal expansion and contraction, and eliminating chance of leaks that occur when tubes and headers are of different materials.

A particular McQuay feature is that *after* the heating unit is completely welded it is dipped into a tin bath, coating it both inside and out. This gives the tubes a glassy smoothness, preventing clogging; and also prevents attacks from impure water.

The motor and fan are supported, according to a McQuay idea, in such a way as to take care of vibration and make them noiseless.

Stop Wasting Heat

McQuay Unit Heaters force the warmed air down into the working areas—where heat is needed. Unlike old-time methods little, if any, heat is wasted in the upper unused portions. Fuel bills are less — and every workman is comfortably warmed.

Even on a cold morning, after the boiler has been banked all night, an entire building can be comfortably heated in a very short time. For, a *few seconds after the heat and fan are turned on a flood of heated air is circulating over the entire floor.* And it keeps on circulating until the heat is turned off.

Each unit can be individually controlled so that the heat is easily turned off in idle parts of a factory.

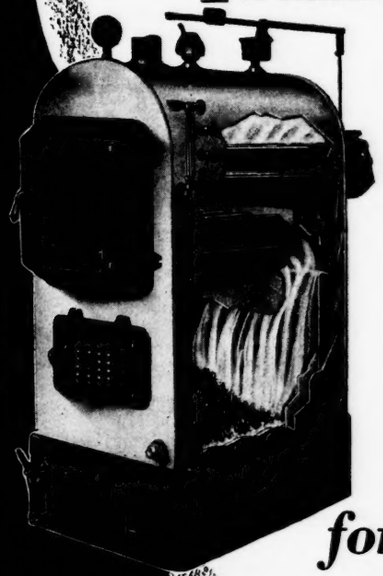
Quickly and easily installed in any building, McQuay Units are made in capacities equivalent to from 50 to 2000 sq. ft. of cast iron radiation. They are excellent supplementary equipment to present inadequate heating systems. Ask for complete data.

McQUAY
UNIT HEATERS
McQUAY RADIATOR CORPORATION
General Offices: 35 East Wacker Drive, Chicago

The NEW KEWANEE STEEL BOILER

A Highly-Efficient Unit for Heating Homes and Smaller Buildings

THE Kewanee Type "R" Residence Boiler has many advantages—*in addition* to its greater strength and consequent longer life.



The shell has extra thickness, of high quality steel plate made into one homogeneous piece. It may easily be carried into a building through any ordinary door, and is then ready to set on the base.

The base, of very heavy cast iron, comes *already assembled* with grate bars in place. Each grate bar rocks on a removable trunnion.

Every unit of Kewanee Type "R" is **practically indestructible.** All castings are substantial to withstand rough usage, the lighter parts being of malleable iron for toughness as well as strength.

Notice particularly the Crown Sheet, the roof of the firebox, which is arched right-side up (a distinctive Kewanee feature). That makes it self-draining, shedding any sediment or loose scale that might be precipitated from the water.

for Every Fuel—Coal, Gas or Oil

Every kind of solid fuel, coke, all grades of soft or hard coals, their briquette or powdered forms; also any liquid fuel oils, and natural or commercial gas can be *burned with high efficiency* in the Kewanee Type "R" Residence Boiler.

In sizes to heat from 370 to 1960 square feet of steam, and from 590 to 3140 square feet of water radiation. Details in Catalog 88.

Now there's a KEWANEE *to heat* Every Size *and* Type *of* Building

KEWANEE BOILER CORPORATION

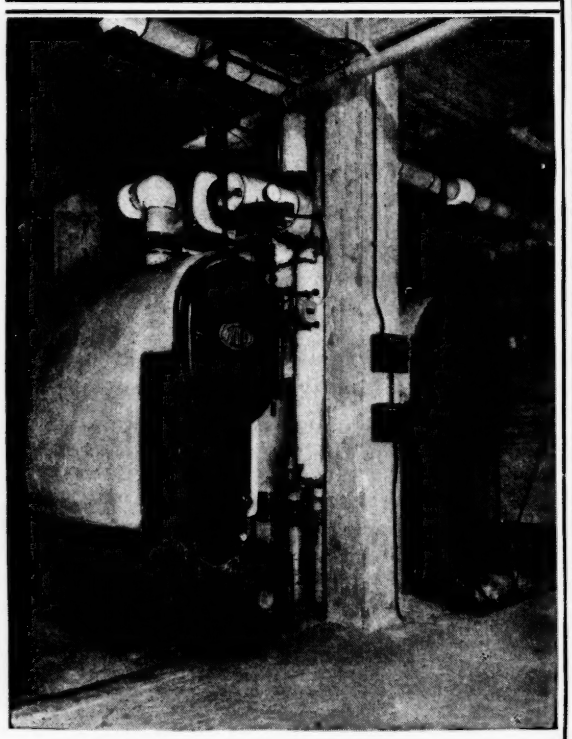
division of American Radiator & Standard Sanitary Corporation

KEWANEE, ILLINOIS

Branches in 40 Principal Cities

HEATING AND VENTILATING, *formerly* THE HEATING AND VENTILATING MAGAZINE, published by BUILDING DIVISION of NATIONAL TRADE JOURNALS, INC., at 521 Fifth Ave., New York, N. Y. Subscription rates: United States, $2.00; Canada, $2.50; Foreign, $3.00. Single Copies, 30 cents. Vol. XXVII, No. 3, March, 1930. Entered as second-class matter, April 18, 1925, at the Post-Office at New York, N. Y., under the Act of March 3, 1879. Copyright, 1930, by NATIONAL TRADE JOURNALS, INC.

Abnormal overload capacity



Pacific Steel Boilers in the Conlyn Towers Apartment, Philadelphia. When negligence put the 18000 ft. boiler out of commission, the 4200 ft. boiler used for summer hot water kept the building warm.

Steel Heating Boilers and Capitol Radiators make a Logical Combination

EDWARD R. SABIN CO.
HEATING CONTRACTORS
SABIN PRESSURE TANK HOT WATER HEATING SYSTEM
QUALITY GAS RANGES
4710-12 MARKET STREET
PHILADELPHIA

December 18, 1929.

Re: Conlyn Towers Apartment
Conlyn Ave & York Road,
Phila., Pa.

Pacific Steel Boiler Corporation
Waukegan, Illinois. -

Gentlemen:

I would like to call your attention to an accident which happened to the #8601 (18000 ft.) Pacific Steel Boiler which we recently installed in the above building.

For several days we were cleaning the system by discharging condensation into the sewer and supplying make-up feed with a Mc Donnel-Miller Water Feeder. For some reason, an attendant at the building shut off the feed supply valve. This would not have been serious except for the fact that the low water cut off switch on the oil burner was not connected and therefore could not operate. Consequently, all the water in the system was evaporated and the boiler heated to a cherry red, remaining so for some time before the accident was discovered and the burner shut off.

When first notified we assumed the boiler would be damaged beyond repair but were agreeably surprised when your local office reported that they would have the boiler in operation again inside of twenty-four hours, having found it only necessary to re-roll the tubes.

During the short time the boiler was out of commission a #8331 (4200 ft.) Pacific Steel Boiler which is used in the Summer for domestic water supply, kept the building comfortably warmed.

We are more than convinced of the ruggedness of your welded construction and conservative net ratings as evidenced by the performance of the smaller boiler during the period of the break down.

Very truly yours,
EDWARD R. SABIN COMPANY
Edward R Sabin
ERS:F President

WHEN a series of mishaps heated the 18,000 foot boiler in Conlyn Towers Apartment, Philadelphia, to a cherry red, the managers thought they were out of a boiler and in for a rush of tenant complaints.

They weren't. Within 24 hours, the big boiler was repaired and back in service.

In the interval, a 4,200 foot boiler, ordinarily used for summer domestic hot water, carried the whole heating load.

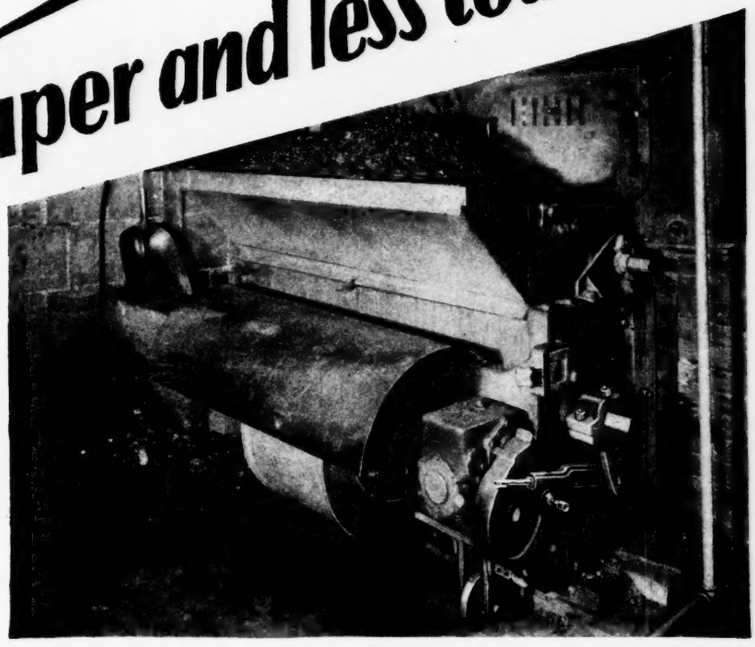
Yes, both boilers were Pacific Steel.

The letter tells the whole story. Read it.

PACIFIC STEEL BOILER CORPORATION
General Offices: Detroit, Michigan
Factories: Waukegan, Ill., Bristol, Pa.
Sales Offices in 58 Cities
Division of United States Radiator Corp., Detroit, Michigan

PACIFIC
STEEL HEATING BOILERS

Save by burning cheaper and less coal



Whiting Model C (low set) Stoker under 185 H. P. Heggie-Simplex Boiler. Cloisters Apt. Bldg., Chicago, Illinois.

The Only Small Stoker With All These Features

Smokeless operation, guaranteed to comply with existing smoke ordinances.

Requires less setting height than most stoker equipment, making it applicable in many plants where it would hardly be possible to install other stokers.

Sizes to fit any boiler 25 to 250 H. P.

Completely automatic operation and control.

Maintains an even fire and complete combustion.

A guarantee of 12% CO_2 and a maximum 25% combustible material in the ash.

Burns the cheapest grades of coal successfully.

Only two moving parts.

Continuous and automatic ash discharge.

Unusually quiet operation at all speeds.

Whiting Model C Stoker (Patented)

The cheapest grades of coal, including low-fusing coals and Western screenings, are being burned with the Whiting Stoker smokelessly and efficiently. Whether your coal is low ash or high ash, coking or non-coking, the Whiting Stoker will handle it with satisfactory results.

Hundreds of plants with small boilers are burning screenings with the Whiting Stoker, saving on every ton consumed the difference in cost as compared with the higher priced coal they formerly burned.

The progressive combustion provided by the Whiting Stoker is so complete and efficient that the tonnage as well as the grade of the coal used is substantially reduced. This two-way saving frequently pays for the Whiting Stoker inside of a year.

Bush Woolen Mills Co., Dresden, Ohio, writes:

> "Our Whiting Stoker has been in constant operation since its installation. We are exceedingly well pleased with its performance. The saving in labor and fuel costs is better than we expected. The saving per month will average better than 60% over our former heating plant."

The above is typical of Whiting Stoker performance.

The Whiting Stoker was designed expressly for small power and heating boilers. It is completely automatic, reducing operating cost to a minimum. It is made in 62 sizes to exactly fit all boilers from 25 to 250 H. P. with few changes in existing equipment. Maintenance is exceptionally low, owing to simplicity of design and rugged construction. The Whiting is the simplest scientific stoker ever built.

An investigation is well worth your while. Write for literature and tell us the size and type of your boilers.

Harrington Division
WHITING CORPORATION
15695 Lathrop Ave., Harvey (Chicago Suburb) Illinois

WHITING STOKER

Joseph Harrington, Engineer

Truly Universal··

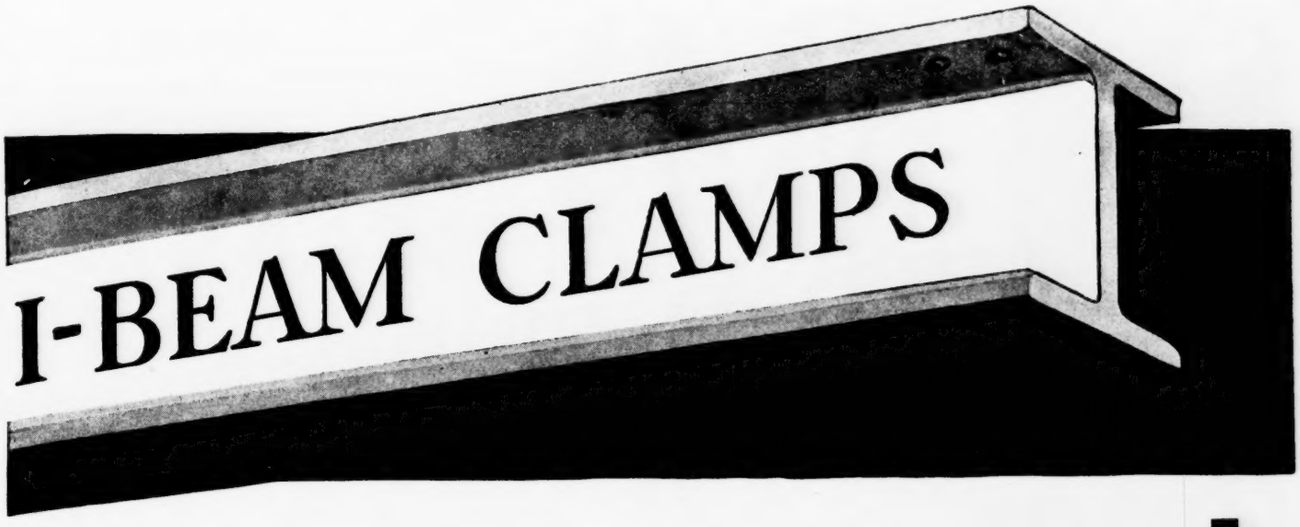
THREE sizes of these rugged UFS—Universal Forged Steel—I-Beam Clamps carry pipe from ¾ inch to 24 inch, and fit flanges of all standard I-Beams up to 24 inches in size—truly adaptable to every conceivable condition in pipe line support.

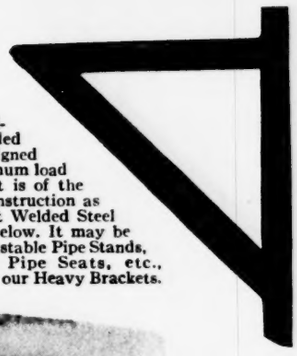
UFS I-Beam Clamps and the Grinnell line of adjustable pipe hangers mean real money saving in lowered installation costs.

There are a hundred kind of Grinnell pipe hangers, all adjust-

GRINNELL

Executive Office: Providence, R. I.





This Grinnell (medium weight) Welded Steel Bracket is designed to support a maximum load of 1500 pounds. It is of the same type and construction as our Heavy Weight Welded Steel Brackets, shown below. It may be used with our Adjustable Pipe Stands, Anchor Chairs, Pipe Seats, etc., in the same way as our Heavy Brackets.

able. No temporary support of the pipe line is necessary while making adjustments.

They insure large savings over specials

Specify Grinnell adjustable pipe hangers and supports. They insure large savings over the cost of specials made on the job. Among other *practical* advantages they permit vertical adjustment.

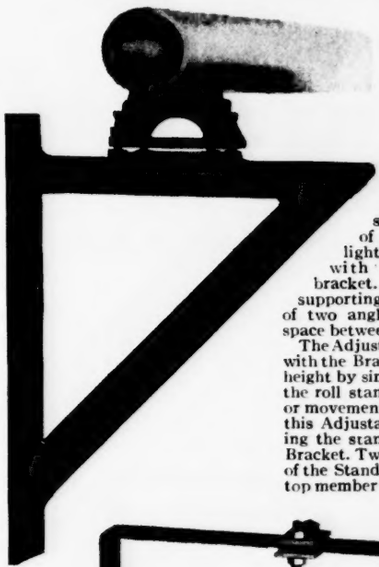
You will find the Grinnell Pipe Hanger Catalogue No. 5 and Engineering data on Pipe Fabrication Book valuable for their ready reference tables covering pipe hangers and supports, fabrication data, etc. and the Grinnell Universal Forged Steel I-Beam Clamps. Write for your copy of either one or both. Address Grinnell Company, 208 West Exchange Street, Providence, R. I.

* * * * *

Specify GRINNELL pipe hangers and supports

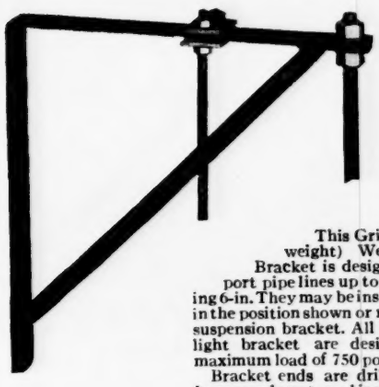
COMPANY

Branches in all Principal Cities



Grinnell (heavy weight) Welded Steel Brackets are designed to support a load of 3,000 pounds, yet are light in weight as compared with the usual cast iron bracket. Top of bracket and supporting brace are constructed of two angle irons with one-inch space between.

The Adjustable Pipe Stand shown with the Bracket is adjustable as to height by simply adjusting bolts on the roll stand. Lateral adjustment or movement is also possible with this Adjustable Pipe Stand by sliding the stand on the Welded Steel Bracket. Two lugs cast on the base of the Stand slide in a groove on the top member of the Bracket.

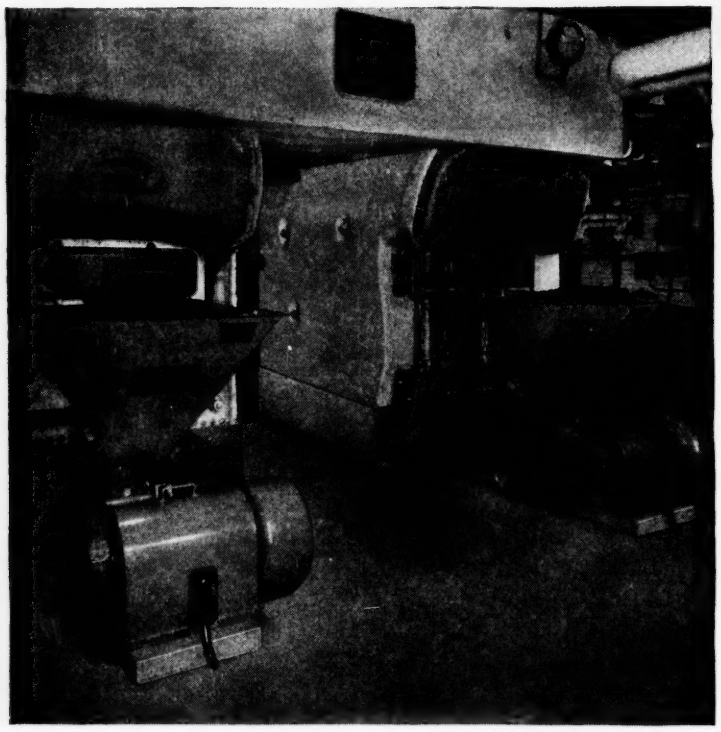


This Grinnell (light weight) Welded Steel Bracket is designed to support pipe lines up to and including 6-in. They may be installed either in the position shown or reversed as a suspension bracket. All sizes of this light bracket are designed for a maximum load of 750 pounds.

Bracket ends are drilled to take hanger rods up to and including ¾ in. in diameter, and pipe as ordinarily suspended from this point.

Pipe 3½-in. and smaller may be hung from any other point on the horizontal member by using the Grinnell Steel Bracket Clip, shown at a midpoint on the horizontal number.

$1.80 a ton saved



Two Detroit Junior Stokers at Detroit Golf Club

THE MANAGEMENT OF DETROIT GOLF CLUB REPORTS:

"We have cut the cost of boiler room operation considerably with Detroit JUNIOR Stokers. We are now buying a cheaper coal and are saving $1.80 a ton on the delivered price. We also burn fully 20% less coal.

"As the stoker furnishes automatic heat with little attention we are able to dispense with one man in the boiler room. This saving alone amounts to $1,800 a year.

"Our stokers will easily pay for themselves in one year's time."

• *You, too, can save money with Detroit Stokers. A type and size for every service. For Detroit* JUNIOR *Stokers, ask for Bulletin 373* •

DETROIT STOKER COMPANY
Third Floor General Motors Building
DETROIT • MICHIGAN

Detroit Golf Club

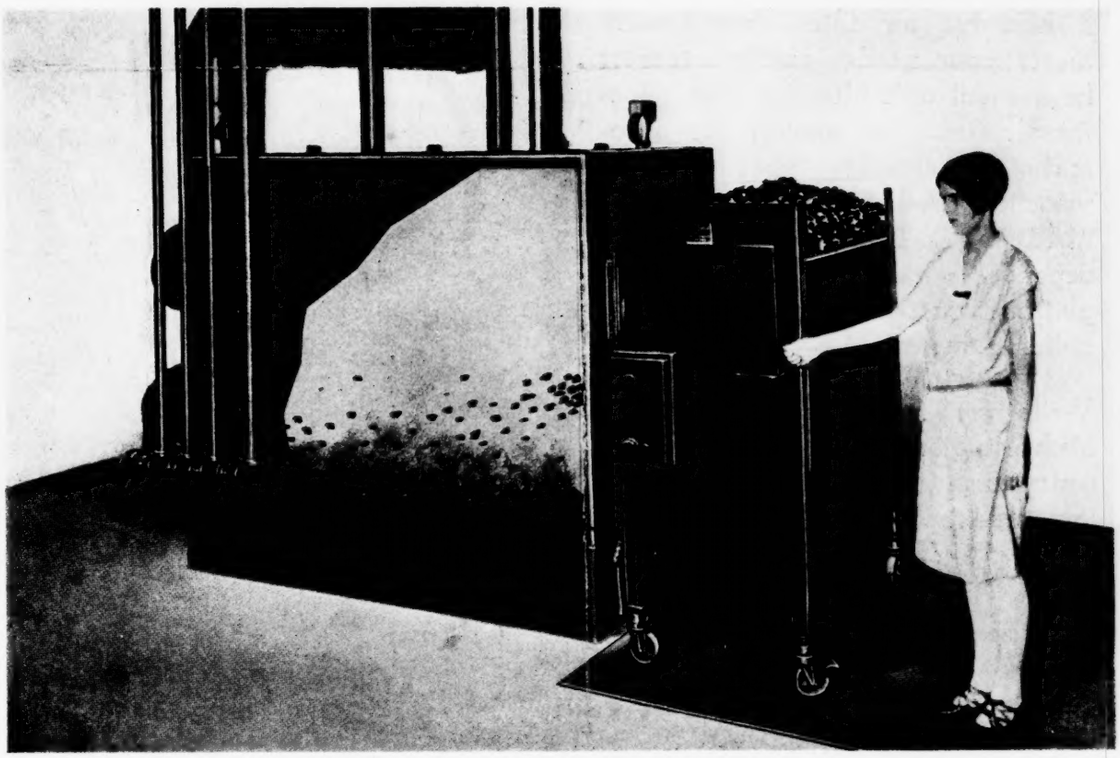
DETROIT JUNIOR STOKER

A TRIUMPH IN COMBUSTION ENGINEERING

The Auto-CoaLa

(An Automatic Stoker)

for Your Heating Plant



INEXPENSIVE—RELIABLE—EASY TO INSTALL and OPERATE

Use the small sized anthracite, soft coal or coke with the . . . Auto-CoaLa Stoker

THE Auto-Coala feeds and sprinkles the coal evenly over the entire grate surface automatically as needed, aiding combustion and preventing loss of hot gases through chimney.

This machine is very quiet in its operation. The hopper holds approximately 500 pounds of coal, sufficient to operate the average boiler for eight to ten hours. Operates day and night with very little attention.

Being equipped with Tork Clock, the stoker can be set to stop and start as desired, as for instance you may wish it to stop at 10 P. M. and start itself again at 6 o'clock in the morning.

Constant supply of steam is maintained by a pressure control switch. Room thermostat working in connection with the regular pressure control may be added if desired.

The advantage of this installation is, should electric current fail, swing stoker back and fire by hand in regular way. No cutting or changing of boiler is required to install the Auto-Coala.

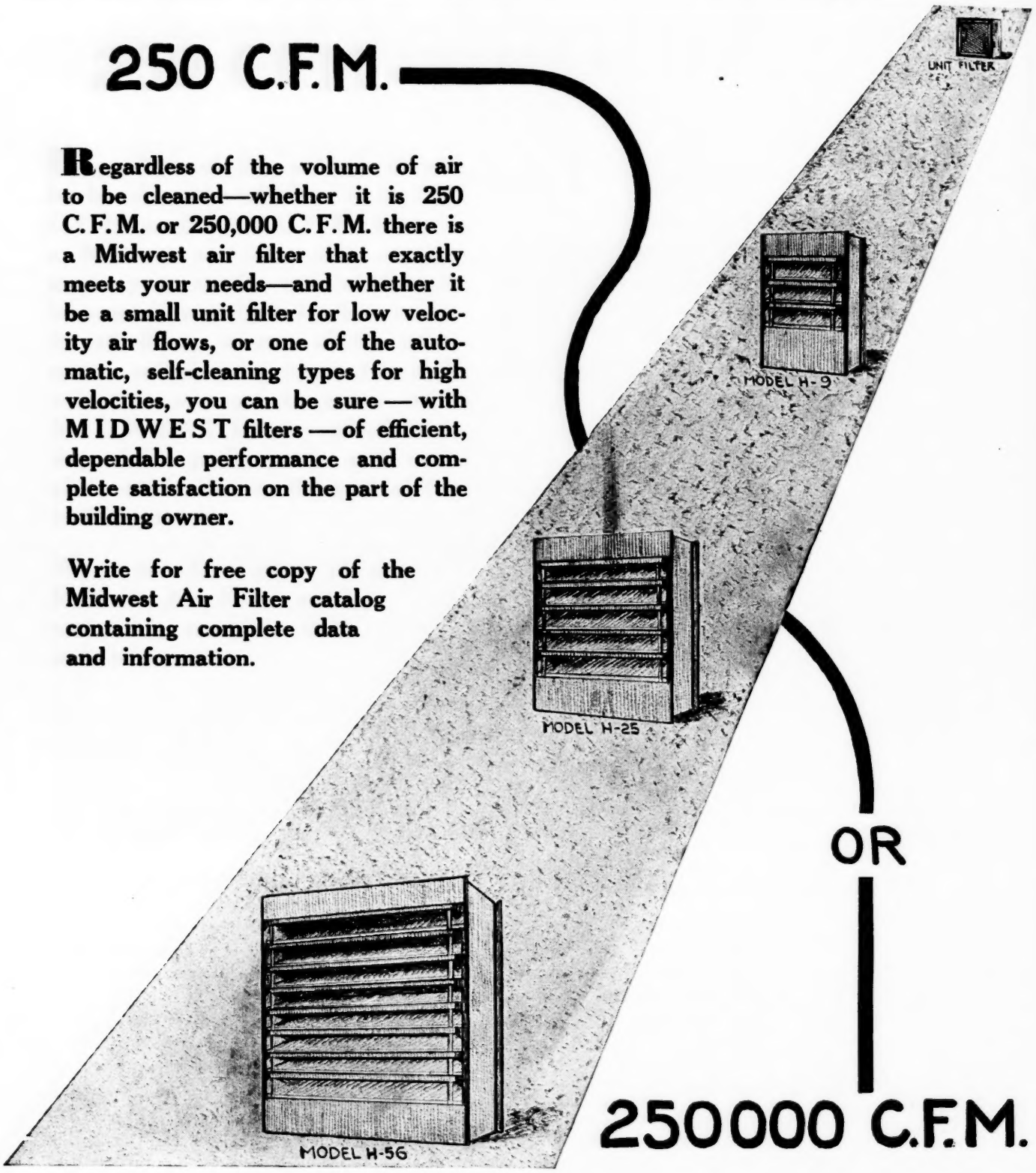
Territories open for Heating Engineers or Distributors with merchandising facilities.

Auto-CoaLa Corp., 204 East 38th Street, New York

250 C.F.M.

Regardless of the volume of air to be cleaned—whether it is 250 C.F.M. or 250,000 C.F.M. there is a Midwest air filter that exactly meets your needs—and whether it be a small unit filter for low velocity air flows, or one of the automatic, self-cleaning types for high velocities, you can be sure — with MIDWEST filters — of efficient, dependable performance and complete satisfaction on the part of the building owner.

Write for free copy of the Midwest Air Filter catalog containing complete data and information.



OR

250000 C.F.M.

MIDWEST AIR FILTERS

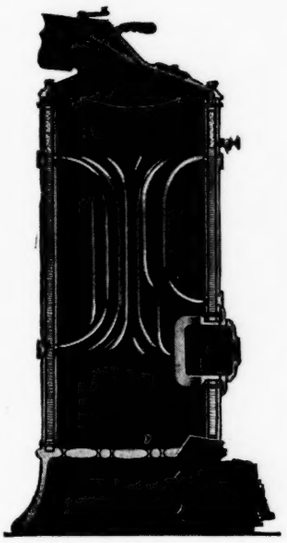
MIDWEST MANUFACTURING COMPANY

BRADFORD, PENNA.

OFFICES IN PRINCIPAL CITIES

Licensed under American Air Filter Company Patents

There is No Substitute *for* Monitor "U" Tube Boilers



The Monitor "U" Tube Steel Boiler

A thoroughly modern Boiler, carefully designed for the highest quality and efficiency and made to produce more hot water per pound of fuel than any other Boiler of equal grate area now on the market.

Adaptability

For High or Low Pressure Steam, Vapor and Hot Water Heating. Constructed for Coal, Gas or Oil Burning.

For Residences, Apartments, Churches, Garages, Schools, etc.

Design

Simplicity in Design with no flat or horizontal surfaces to collect soot.

"U" Tube construction, with no dead ends to fill up, eliminates danger of burned out tubes.

Construction

Shells of best open-hearth, high tensile Steel. "U" Tubes of highest grade charcoal iron.

Bases, Grates and Domes of heavy Cast Iron.

Economy

Unequalled value at lowest operating cost. Continuous circulation of water through tubes and shell.

Less fuel required to produce and maintain steam than with any other Boiler.

Reliability

Due to construction Monitor "U" Tube Boilers cannot crack or explode.

No danger of having your heating plant out of commission in mid-winter.

Many Monitor Boilers in constant use since 1888.

MONITOR "U" TUBE STEEL BOILERS

formerly Manufactured by the

MONITOR BI-LOOP RADIATOR COMPANY

Now being Manufactured and Sold by

LANCASTER IRON WORKS, *Inc.*

Specialists in Steel Plate Construction

Main Office and Works

New York City **LANCASTER, PA.** **Philadelphia**

63°

For the Bed Room—

Sixty-three degrees is a sensible temperature for the spare bedroom or for the bedroom that isn't used during the day. There is little use heating the bedroom the same temperature as the living room when it isn't necessary for the comfort of the home-dweller. The fine thing about the Duplex Unit Control Heating System is that every room has its own thermostat. Heat is never wasted. Gas is burned so economically that anyone can afford it.

73°

For the Living Room—

With the Duplex system while the bedroom is sixty-three degrees, the living room can be heated to seventy-three degrees or any other temperature to suit the fancy of the home-dweller. All the comforts of gas heat are obtained, with a minimum of expense for gas fuel. Certainly your customers will be very glad to learn of the remarkable advantages of the Duplex System.

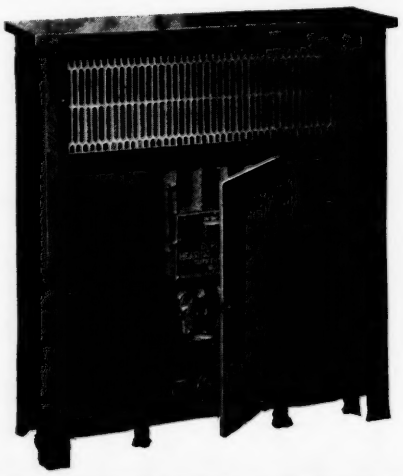
83°

For the Bath Room—

Most people like their bathroom at a warmer temperature than the rest of the house. Eighty-three degrees seems a sensible temperature for the bathroom. It is the simplest thing in the world to have just the right temperature to suit every one's taste where the Duplex System is used.

The Duplex Unit Control Gas Heating System operates on an entirely new and modern principle. Gas is burned in a radiator unit in a partial vacuum. The products of combustion are drawn off by an electrically driven exhaust fan, and expelled to the outer air. Each radiator operates from an independent thermostat. It is being successfully used in heating homes, offices, factories and garages. In the interests of your customers write for complete information. No obligation.

DUPLEX UNIT CONTROL GAS HEATING SYSTEM



ROBERTS-GORDON APPLIANCE CORPORATION

DELAWARE AVENUE AT TUPPER STREET

CURTISS BUILDING BUFFALO, N. Y.

NOW!

Stanwood Boilers

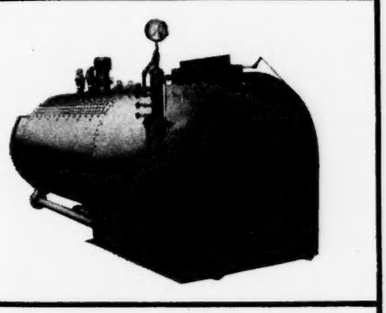
for every type of heating and power service!

Any size boiler job is a Stanwood size job—NOW! For with the addition of the new Electric Welded Boiler, Stanwood presents a complete Line—nationally recognized—conclusive evidence of a profound knowledge of boiler engineering principles.

The experience of thirty-nine years in the boiler building industry shows up clearly in this new welded boiler which has been designed and produced especially to meet the demands for a compact low pressure steel heating boiler.

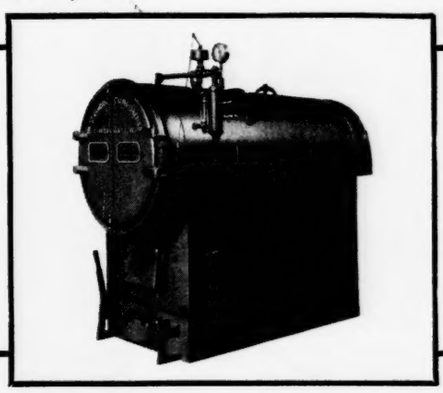
All Stanwood Boilers are furnished for hand firing with coal or mechanical firing with stoker, oil or gas.

For the convenience of those men who specify boilers, we have prepared bulletins giving full details, foundation dimensons, etc.



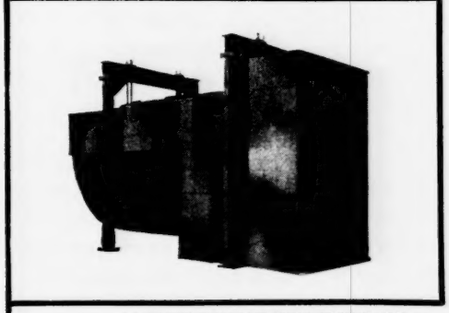
STEEL RIVETED SMOKELESS BOILER.

1. Very low water line—minimum headroom—rapid water circulation—quick steamer. Heavily constructed of steel plus rivets for 15, 100, 125 and 150 lbs. pressure—ask for Bulletin 500.



STEEL WELDED HEATING BOILER.

2. Smokeless or Direct Draft type. Compact, requires minimum space. All seams and joints electrically welded into one solid leak proof unit for 15 lbs. pressure. Ask for Bulletin 100.



HORIZONTAL RETURN TUBULAR BOILER.

3. Enclosed in Stanwood Bag Type Steel Casing—reduces maintenance costs and eliminates air leakage. Also furnished for box casings or brick settings. Pressure 100, 125, or 150 lbs.—ask for Bulletin 517.

Gentlemen:

Please send me bulletins as checked.

☐ 500 ☐ 100 ☐ 517

Name .....

Address .....

City ..... State .....

The Stanwood Corporation

Dept. D. 330 Cincinnati, Ohio

Branches in Principal Cities

An Engineer's Time goes into the Operating Cost of a Heating Boiler—Conserve it!

some inches are vital!

No boiler tubes last forever. But do you think ahead to replacement-time when you O.K. a boiler selection? We can tell where *a few inches more or less* affect tube replacement vitally.

TITUSVILLE "SR" Welded Boilers

are built for the man who is looking ahead. You can retube a Titusville Boiler with less trouble and less expense. For one thing, you have smoke-box doors so wide that the engineer can slide new tubes in without springing or forcing. And the whole bottom of the rear smoke-box is a removable plate, so he can expand in the new tubes without disturbing the breeching. There's a place to plan for future savings. Specify "Titusville" for first and last economy.

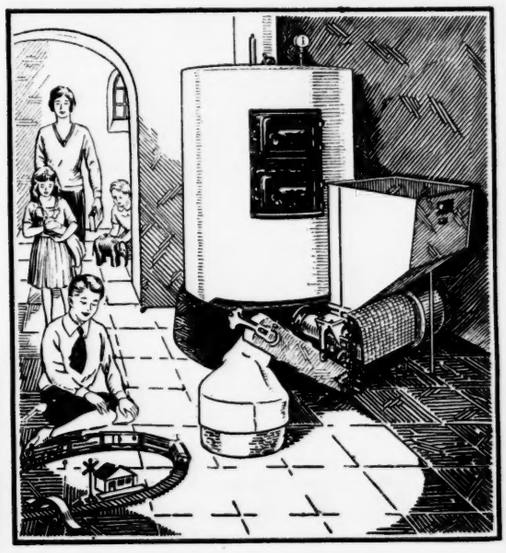
Let our nearest office show you how Titusville Boilers excel in other ways, too.

THE TITUSVILLE IRON WORKS COMPANY
Division of Struthers Wells-Tutusville Corporation
TITUSVILLE, PA.
Branch Sales Offices in all Principal Cities

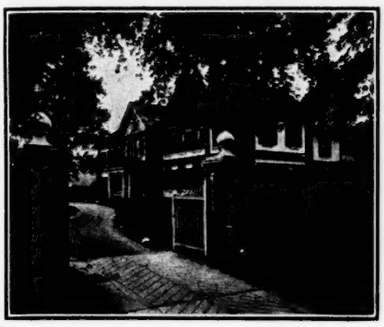
Titusville Type SR Boilers economize on boiler-room floor space most effectively

MODERN AUTOMATIC HOME HEAT *for* EVERYBODY

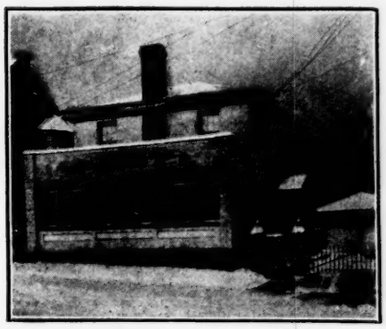
NO SMOKE
NO SMUDGE
NO SOOT
NO ODOR
NO DANGER



MAKES MAGAZINE
BOILERS AUTOMATIC
SAVES FROM 40
TO 80 PERCENT
OVER OIL OR GAS



For Those Who Can Afford the Best.
Also Within the Price Range
of the Modest Home



Readily Installed in any Heating System

(Steam — Vapor — Hot Water — Warm Air)

The ELECTRIC FURNACE-MAN makes PENNSYLVANIA ANTHRACITE AUTOMATIC. No longer is it necessary to resort to "substitute" fuels to obtain the luxuries of automatic heating.

The ELECTRIC FURNACE-MAN is easily installed in YOUR PRESENT FURNACE OR BOILER.

The ELECTRIC FURNACE-MAN, by automatically feeding just the right amount of coal with just the right amount of air, MAINTAINS A CONTINUOUS FIRE in proportion to your heating requirements, no matter what the outside temperature may be.

The ELECTRIC FURNACE-MAN automatically REMOVES THE ASH to a sealed container on the floor level outside the furnace or boiler.

NO DRAFTS TO REGULATE — NO GRATES TO SHAKE

CLEAN — SAFE — ECONOMICAL — ACTUALLY REDUCES HEATING COSTS

MORE THAN 10,000 SATISFIED USERS

DEALERS IN OVER 300 CITIES

SEE INTERESTING DISPLAY AT LOCAL DEALERS

The Electric Furnace-Man

Endorsed by Anthracite Operators Conference
A Billion Dollar Industry

AUTOMATIC ANTHRACITE HEAT

(Patented Automatic Coal Burner)
Product of Domestic Stoker Company
7 Dey Street, New York

MONCO

STEEL HEATING BOILERS

for

COAL OR OIL BURNING

▲

FIRE TUBE BOILERS
COIL WATER HEATERS
COIL HEATING BOILERS

▼

WRITE FOR COMPLETE
INFORMATION

MONITOR BOILER COMPANY

1505 RACE STREET PHILADELPHIA, PA.

Announcing Type 'B'

--A Companion Control to the Penn Room Thermostat Type A

TO say that the Type B Penn Room Thermostat is a new switch hardly would be fitting. It is in reality a "chip off the old block" . . . a companion control to the already popular Type A Penn Thermostat. It has been designed primarily for those engineers who have expressed a preference for Bi-metallic metal instead of the charged bellows for operation of the magnet contact structure. It fills an existing need for a control of high Penn Standards yet moderate in price.

Like its companion switch, the Type B simplifies the wiring job for unit heaters. It, too, is designed for across the line service, and carries the load direct. It requires no magnetic contactors, relays, or transformers on motors up to 1/3 H.P. Single Phase, A.C. or D.C. and is suitable for pilot service up to 550 volts.

In addition to their amazing capacity to carry heavy loads direct, Penn Controls, both Types A and B, can be quickly and easily mounted in any position without affecting their setting. Both operate on a differential of less than two degrees, insuring uniform heat and economical operation. Their dependability and durability have been proven under every conceivable test and actual service condition.

Reliable manufacturers and dealers, write for complete information and thermostat for test purposes. Specify whether you desire Type A or B.

RATINGS: Type A, for 1 H.P. single phase A.C. and 1/2 H.P., direct current. Maximum voltage 550.

Type B, for 1/3 H.P. single phase A.C. and 1/3 H.P., direct current. Maximum voltage 550.

A special Room Thermostat for current loads up to 30 amperes A.C. non-inductive can be supplied for electric space heaters, etc.

Manufactured by an organization of proven engineering ability that supplies the largest and best concerns of the country with automatic controlling devices.

PENN ELECTRIC SWITCH CO.

DES MOINES, IOWA

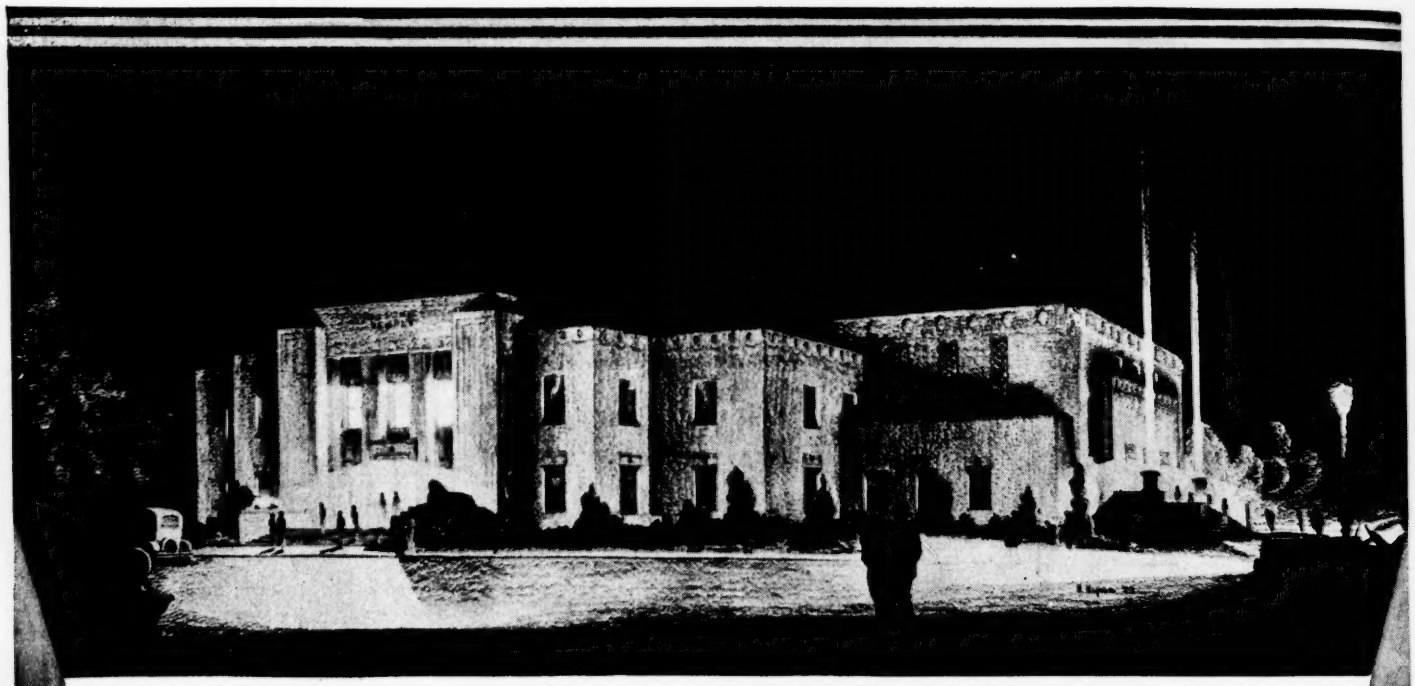
A COMPLETE LINE OF AUTOMATIC SWITCHES FOR

Oil Burners Pumps Refrigerators Air Compressors

INCLUDING

Thermostatic Switches Float Switches

Unloader Pilots Vacuum Switches Pressure Switches

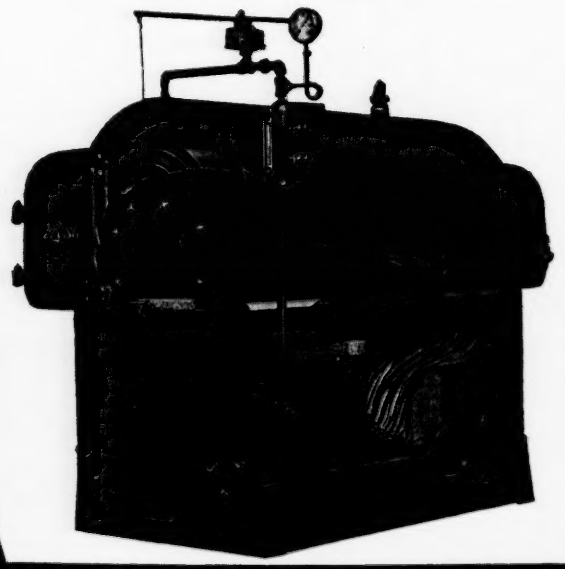


Masonic Temple, Fort Smith, Arkansas, two 10,000 foot Ross Boilers installed. George R. Mann, Wagner and King, Architects; Haralson and Nelson, Associate Architects . . . . . Eldorado Plumbing and Heating Co., Heating Contractors.

ROSS
STEEL HEATING BOILERS

Details and specifications on request.

THE FROST MANUFACTURING COMPANY
GALESBURG, ILLINOIS

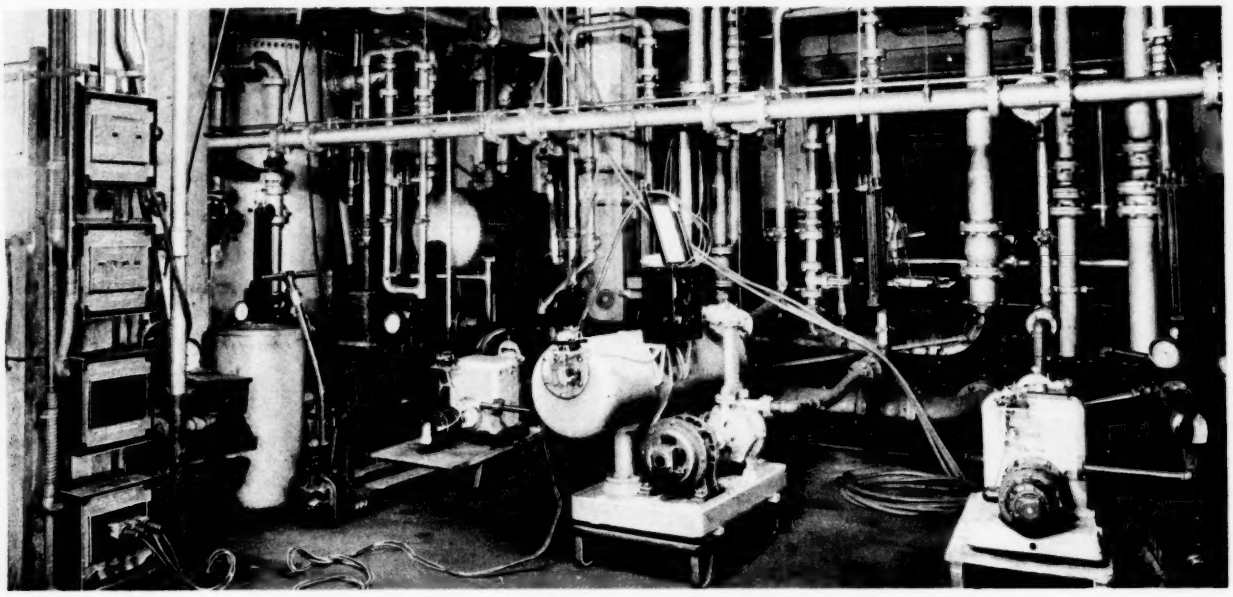


ECONOMICAL · EFFICIENT · DURABLE

Square foot ratings *often* "bite off more than the pump can chew"

To Determine a Heating Pump's Fitness for a specified radiation

tested air and water capacity is essential



General View of Laboratory in Nash Factory where Jennings Pumps are Tested

A vacuum heating pump removes condensation and air from the return line vacuum steam heating system. The quantities it is called upon to handle depend upon several factors. One is the amount of radiation in the system. Others are the degree of tightness of joints and fittings, the efficiency of traps, and the cooling effect of the return piping.

To rate a vacuum heating pump for a given number of square feet of direct radiation is acceptable only if the pump's capacity is sufficiently large to handle the returns from the radiation under the most unfavorable operating conditions likely to exist in practice.

Simultaneous water and air capacity of the pump and not its catalog square foot rating, is the dominant factor that determines the system the pump can serve satisfactorily.

Jennings Capacities are Determined by Tests

Jennings square foot ratings are supported by actual tested capacities. Every Jennings Pump is tested at the factory before shipment. The volume of water that the pump withdraws from the receiving tank under a prescribed vacuum and delivers against a specified head is accurately measured. At the same time the number of cu. ft. per min. of air that the pump removes from the receiving tank and discharges to the atmosphere is determined by the most reliable device available for the purpose...a calibrated test orifice. Horsepower required to deliver these quantities is found.

STANDARD TEST ORIFICE

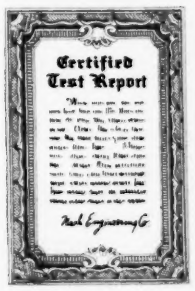
Exclusive Jennings Design Assures Dependable, Economical Operation

Air and water are handled independently by the Jennings Vacuum Heating Pump. Air capacity is not affected by the volume of water being pumped. Water capacity remains constant when air is being handled.

A Jennings Pump will serve satisfactorily any reasonably well installed system of the size for which it is recommended, for the life of the building. Jennings capacities, as given in the table, are adequate under all conditions found in actual practice.

Condensate is handled only once. Less horsepower is required. Economical operation assured. These features are found only in the Jennings Pump.

Certified test reports, furnished to purchasers on request, guarantee Jennings capacities and horsepower, and afford the only reliable basis on which to compare vacuum heating pumps.



CERTIFIED REPORT OF TEST

CAPACITIES OF JENNINGS VACUUM HEATING PUMPS

Pump Size	Equivalent Direct Radiation Square Feet	Water Capacity G.P.M.	Air Capacity Cu. Ft. Per Min.	Orifice Diameter Inches	MOTOR HORSEPOWER* 10 Lbs.	20 Lbs.	30 Lbs.	40 Lbs.
T	2,500	4	3	3/64	1/8	1/2	1	1 1/2
U	5,000	9	3	3/64	1/8	1/2	1	1 1/2
V	10,000	14	6	5/64	1	1	1 1/2	2
B	16,000	22	9	3/16	1 1/2	2	3	5
C	26,000	35	15	1/4	2	3	5	5
D	40,000	60	19	9/32	3	5	5	7 1/2
E	65,000	90	34	3/8	5	5	7 1/2	10
F	100,000	140	50	7/16	7 1/2	10	15	15
*G	150,000	200	102	9/16 & 5/16	10	15	UPON REQUEST	
*H	300,000	400	171	2-7/16 & 1-9/16		UPON REQUEST		

* *The last two sizes are out of the manifold type.*

Jennings Pumps

NASH ENGINEERING CO.
SOUTH NORWALK, CONN., U. S. A.

A fresh field of profit within your own business

The Electrol dealer will help you develop extra income from oil burner sales

Without additional investment or increase in overhead, you can open up a new field of profit in your present business. By co-operating with the Electrol dealer to sell Electrol all-electric oil heat to your clientele, you can add an extra yield to your present income.

You can use the complete facilities of Electrol's sales and service organization to enlarge the scope of your present service. You will become equal to any job of oil heating . . . able to handle every oil-burner prospect in your territory to the best advantage.

Your friends and customers will be glad to hear that you and Electrol are co-operating. Your working arrangements with the Electrol dealer will bring in a commission that is clear profit.

Examine the details of this proposition for yourself. Talk it over with the Electrol dealer in your city or community. If you don't know his name, write us and we will have him get in touch with you.

ELECTROL INCORPORATED
227 East 45th Street New York City

Benefit by Electrol's leadership

In associating yourself with Electrol, you profit from the reputation of the world's largest producers of quality oil burners. Outstanding men, sound engineering, exclusive patents, aggressive merchandising policies and thorough dealer co-operation assure the Electrol leadership which the capable heating contractor can enlist as a part of his own service.

Send for these new bulletins: "The Electrol Oil Burner Is Adaptable to All Types of Heating Systems" and "Household Heat and a Year-Round Hot Water Supply with the Same Electrol Oil Burner" have just been published for the information of heating men. Copies will be mailed free upon request.

MEMBER OIL HEATING INSTITUTE

ELECTROL

The* OIL BURNER *with the Master Control

LISTED AS STANDARD BY THE UNDERWRITERS' LABORATORIES

ELECTROL INCORPORATED,
227 E. 45th Street,
New York City, N. Y.

Please send me copies of the two bulletins described in current issue of Heating and Ventilating.

Name.....

Address.....

City.....

"AT HOME"

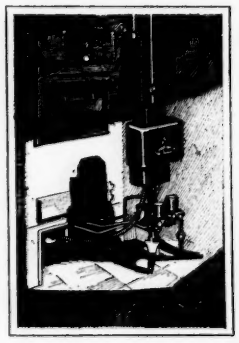
. . . in the new plant of the world's largest producer of domestic oil burners

WORLD LEADERSHIP

SILENT AUTOMATIC is now occupying the new manufacturing plant which has been especially designed and built to meet the production requirements of the fastest selling oil burner on the market today.

This new home of Silent Automatic is equipped with the best and latest facilities for maintaining high quality standards in quantity production.

Silent Automatic's rise to world leadership in five years has been an amazing achievement, even in the oil burner industry, which has swept ahead with giant strides. Silent Automatic approaches the 1930 selling season in the strongest financial position in its history—with the full facilities of its fine new plant now available—and with a merchandising program, based on successful experience, that stands alone in the oil burner industry in the definite and soundly practical way in which it points the way to substantial dealer profits.



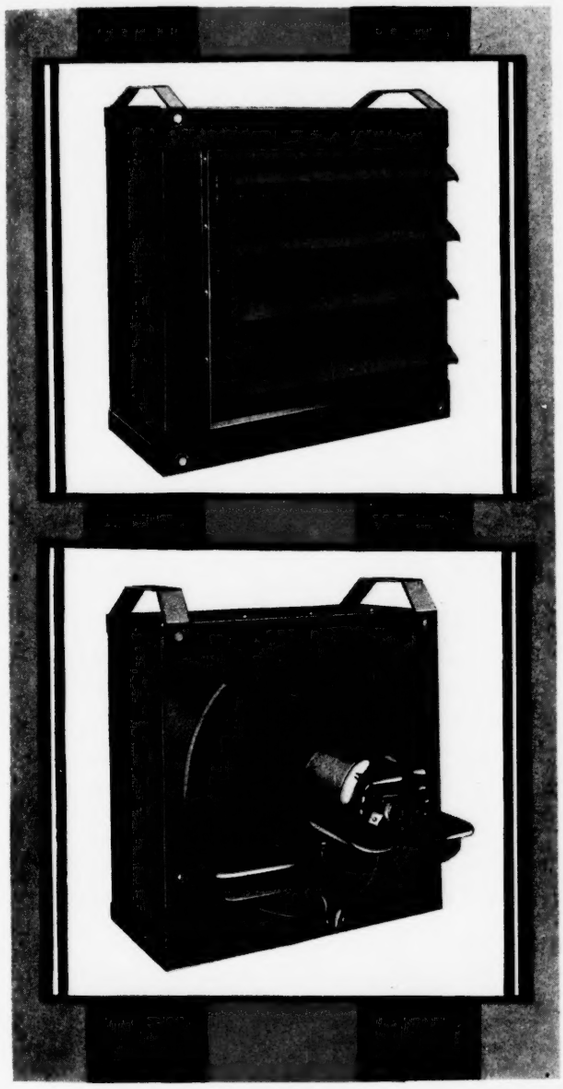
We are interested in hearing from established dealers who would like to learn the full details of Silent Automatic's 1930 franchise opportunity.

SILENT AUTOMATIC CORPORATION
12001 East Jefferson Avenue Detroit, Michigan

SILENT AUTOMATIC
THE NOISELESS OIL BURNER

(247)

ANNOUNCING
The MASSACHUSETTS



UNIT 15 HEATER

This new ceiling suspension type heater displaces 1200 cubic feet of air per minute ..... equivalent of 300 square feet of direct radiation at only a fraction of the cost.

The BISHOP & BABCOCK SALES COMPANY, Cleveland, O.

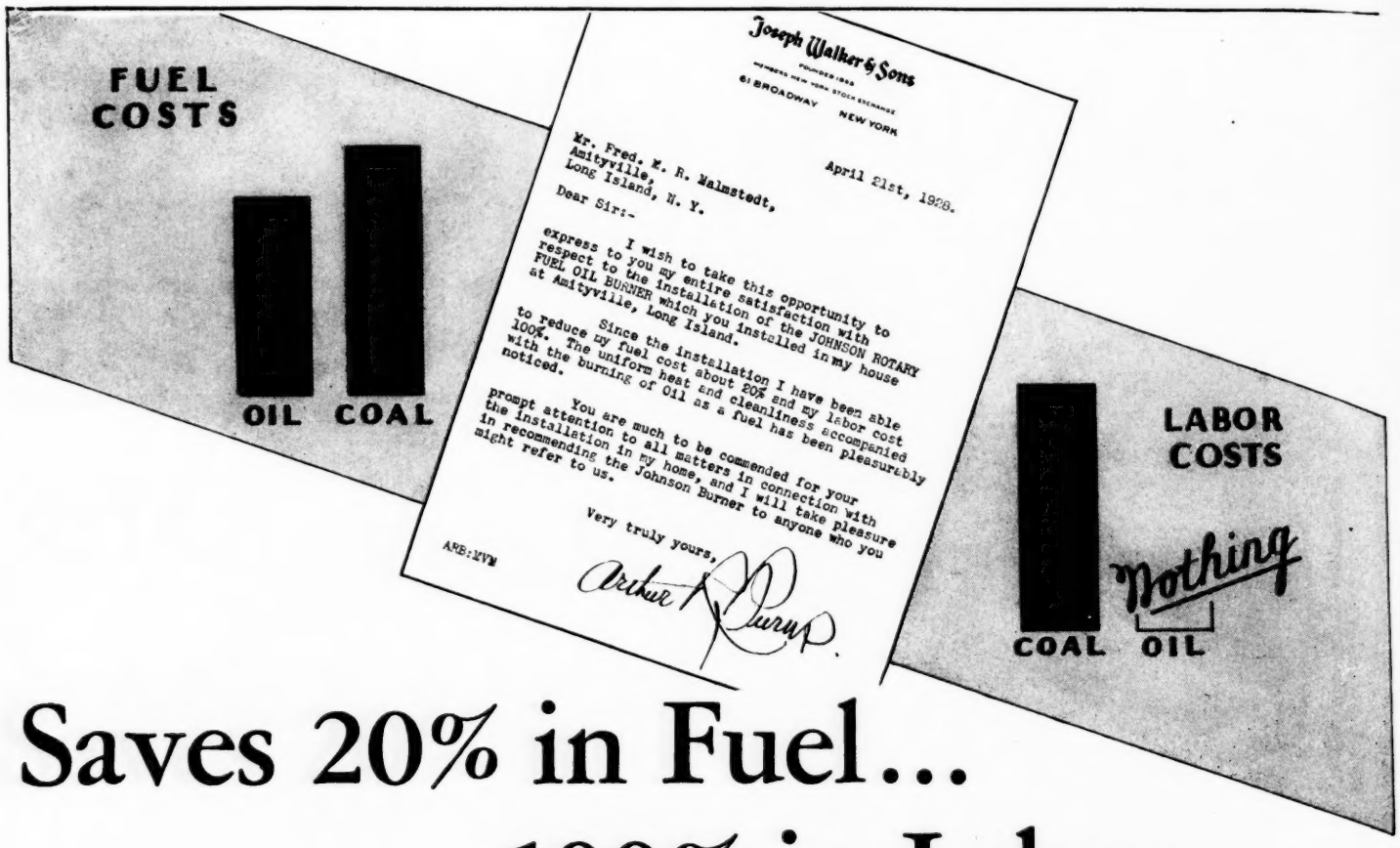
General Offices—4901-4915 Hamilton Avenue, N. E.

SALES AND SERVICE OFFICES

Baltimore Boston Washington, D. C. Bridgeport St. Louis Buffalo Chattanooga Chicago Cleveland Birmingham, Ala. Denver Detroit Little Rock Los Angeles Minneapolis Duluth Memphis Pittsburgh New York Oklahoma City San Antonio Philadelphia Miami, Fla. Nelsonville, Ohio Orlando, Fla. Springfield, Ill. Winston-Salem, N. C. Richmond Spokane Cincinnati Tulsa Tokyo, Japan

BISHOP & BABCOCK

TEMPERATURE REGULATION
HEATING SPECIALTIES VENTILATING EQUIPMENT


FUEL COSTS
OIL COAL
Joseph Walker & Sons
61 BROADWAY NEW YORK
April 21st, 1928.
Mr. Fred. W. R. Walmstedt,
Amityville,
Long Island, N. Y.
Dear Sir:-
I wish to take this opportunity to express to you my entire satisfaction with respect to the installation of the JOHNSON ROTARY FUEL OIL BURNER which you installed in my house at Amityville, Long Island.
Since the installation I have been able to reduce my fuel cost about 20% and my labor cost 100%. The uniform heat and cleanliness accompanied with the burning of Oil as a fuel has been pleasurably noticed.
You are much to be commended for your prompt attention to all matters in connection with the installation in my home, and I will take pleasure in recommending the Johnson Burner to anyone who you might refer to us.
Very truly yours,
ARB:EVW
LABOR COSTS
Nothing
COAL OIL

Saves 20% in Fuel... 100% in Labor

THIS saving, plus uniform heat and cleanliness, is typical of the dependable, carefree performance of Johnson Oil Burners the world over.

Wherever you may go . . . from California to Maine, and in foreign lands . . . you will find that home owners, builders and operators of large buildings, factories and industrial plants are praising the economical and dependable performance of Johnson Oil Burners for every heating and power purpose.*

You can safely recommend and use Johnson Oil Burners with absolute confidence that they will give enduring satisfaction. The experience of more than twenty-five successful years as manufacturers of oil burning equipment is behind every Johnson product.

The accumulated data of our twenty-five years' experience is available to you. Our Engineering Service Department will welcome the pleasure of assisting you in the solution of your heating or power problems.

We will also be pleased to send a copy of our catalogue, as published in "Sweet's," for your files. Just write "*Bulletin 4-B, please,*" on your letterhead or business card, no obligation incurred, and your copy will be sent without delay.

JOHNSON OIL BURNERS©

Listed as standard by the Underwriters' Laboratories

MANUFACTURED AND GUARANTEED BY

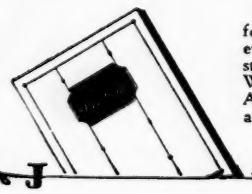
S. T. JOHNSON CO.

Executive Office and Factory: **940-950 Arlington Street, Oakland, California**
Factory Branches: **San Francisco, Sacramento, Stockton, Calif.; Philadelphia, Pa.**

Member Oil Heating Institute

330-H

An Opportunity *for Men of Vision and Ability...*



Profits in the oil burner business are limited by the market for the burner you represent. There is a Johnson Burner for every heating and power purpose . . . *Rotary Burners in three styles, seven sizes, with either semi or full automatic control. While Natural Draft, Whirlwind, Low Pressure Air and Steam Atomizing Oil Burners, electric and steam driven oil pumping and preheating equipment fill in the gaps . . . blanket the market. The Johnson dealer also enjoys the advantages of selling a burner that will not be "orphaned" . . . he will be given the fullest factory co-operation in developing his territory. Send for our new free book, *"Today's Opportunity."* It tells why the Johnson franchise offers greater dealer profits. This coupon will bring your copy without delay. Mail it now, stating territory desired.

Name *Address*

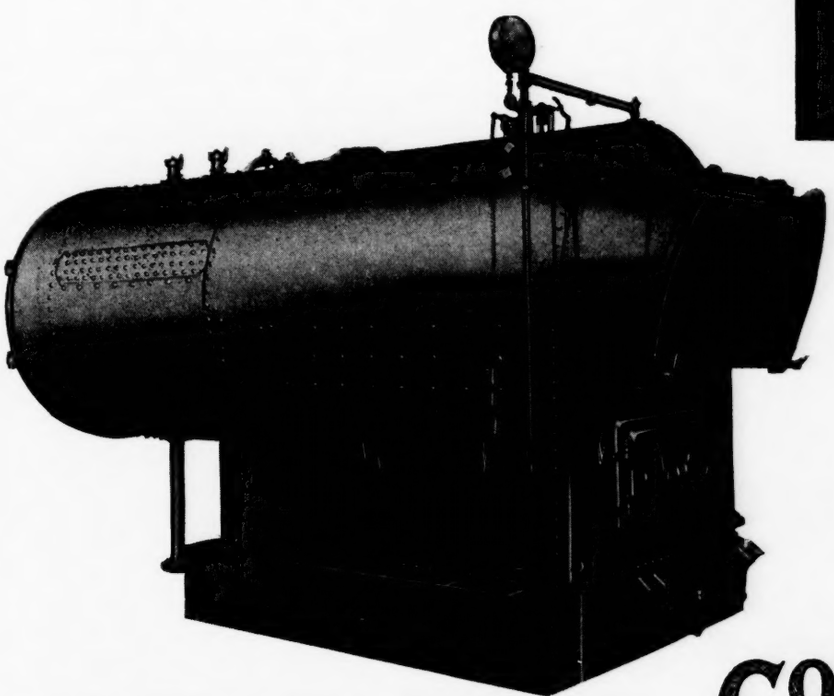
COATESVILLE BOILERS

A NEW office building just completed for the Fire Association of Philadelphia is equipped with three Coatesville Riveted Fire Box Steel Boilers built for 100 lbs. working pressure.

The selection of Coatesville Boilers for this building is a significant fact that the Fire Association of Philadelphia has insured their heating requirements.

ERNEST J. MATTHEWSON, *Architect*
HENRY ADAMS, INC., *Mechanical Engineers*
DOYLE & CO., *General Contractors*
WILLIAM M. ANDERSON, *Heating Contractors*

FIRE ASSOCIATION BUILDING
4th & Walnut Sts., Philadelphia, Pa.



Some COATESVILLE Features

1. Crown sheet self-supporting.
2. Self cleaning crown sheet.
3. Adjustable Hinges. (Insuring tight fit of all doors.)
4. Flue doors close against an asbestos packing ring.
5. Insulated rear combustion chamber.
6. Special steam separator.
7. Adjustable clamps for precise alignment of grates.
8. Large steam space entirely accessible.

MAIN OFFICE & WORKS: COATESVILLE, PA.

Philadelphia 111 S. 15th St.	Pittsburgh Union Trust Bldg.	New York 30 Church St.	Boston 141 Milk St.
Baltimore Lexington Bldg.	Washington, D. C. 208 Evans Bldg.	Detroit 730 Fisher Bldg.	New Orleans 617 Common St.

COATESVILLE BOILER WORKS

Boilers - Tanks - Steel Plate Work

WORK UP YOUR 1930 LIST OF PROSPECTS NOW • •

Between today and the date of the April convention you can work up your prospect list for this year. No reason to mark time. One out of every four houses built in 1930 will be equipped with an oil burner. Who, in your territory, are going to build this season? They are good prospects. And there will be an increased number of burners going into old houses, too. While working up your list, look into the burner situation carefully—if you are not now selling Nu-Ways. Study Nu-Way—the burner, the variety of sizes, the sales methods, the service. On all points, the Nu-Way will appeal to you. Write for complete details, prices, terms, and our selling plan.

THE NU-WAY CORPORATION, ROCK ISLAND, ILL.

Nu-way

FEATURES

QUIET—Extremely quiet—no perceptible flame roar.

COMPACTLY BUILT—Fan and pump mounted directly on motor, thus conserving much space, yet all parts easily accessible. Combustion control and pump are integral parts of machine which naturally cuts installation costs.

REMARKABLE EFFICIENCY—due to extremely fine atomization and the proper mixing of air and oil.

CONTROL OF FLAME SIZE has been reduced to a simple operation.

ALL ELECTRIC IGNITION—Tested and proved dependable.

LISTED AS STANDARD BY THE NATIONAL BOARD OF UNDERWRITERS. THE NEW YORK BOARD OF STANDARDS AND APPEALS.

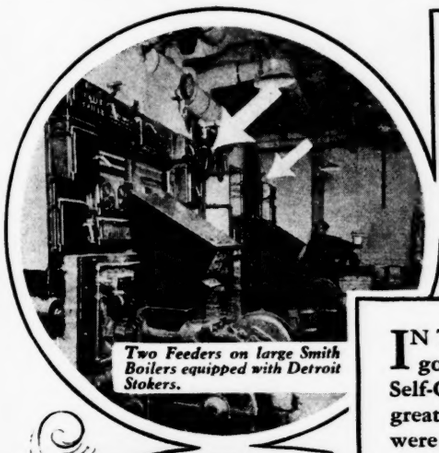
Nu-way

AUTOMATIC

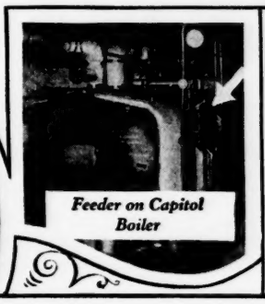
OIL BURNERS

A Size for Any Job

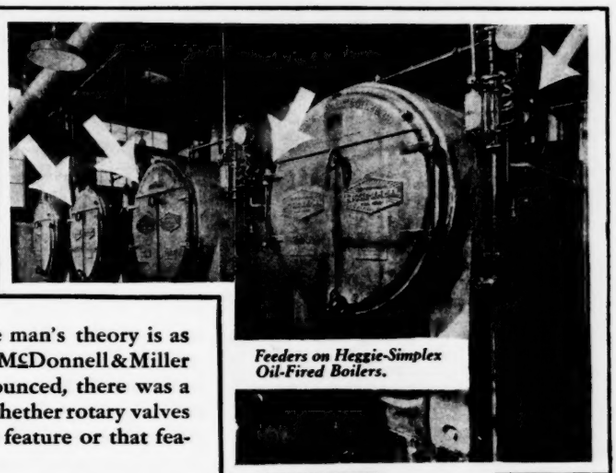
Proved—*in the world's boiler room*



Two Feeders on large Smith Boilers equipped with Detroit Stokers.



Feeder on Capitol Boiler



Feeders on Heggie-Simplex Oil-Fired Boilers.

IN THE absence of facts one man's theory is as good as another's. When the McDonnell & Miller Self-Cleaning Feeder was announced, there was a great deal of speculation as to whether rotary valves were *right*—as to whether this feature or that feature was right.

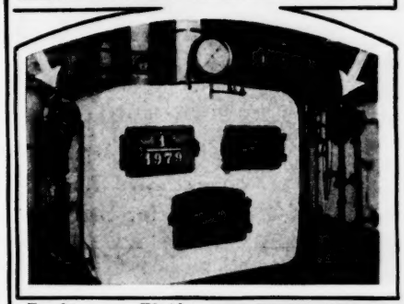
But today hundreds of feeders on boilers of every type operating under every conceivable condition of service have supplied the answer. The McDonnell & Miller Self-Cleaning Feeder now stands squarely on its record. It is a monument to "doing one thing well"—and sticking everlastingly to it. This is brought out, within the limitations of space, by the installations illustrated here.

Not only in the duplex field, but also in the single-valve field, the McDonnell & Miller line is proving its case on the job. The new McDonnell No. 30 Safety Feeder, illustrated below, has given many engineers and contractors a new conception of how good a single valve feeder *can* be built.

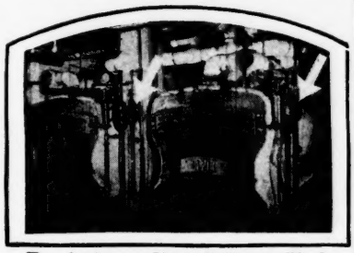
McDONNELL & MILLER
1314 Wrigley Bldg., Chicago
Eastern Office: Grand Central Terminal, New York, N. Y.

McDONNELL & MILLER
Boiler Feeders
"Doing one thing well"

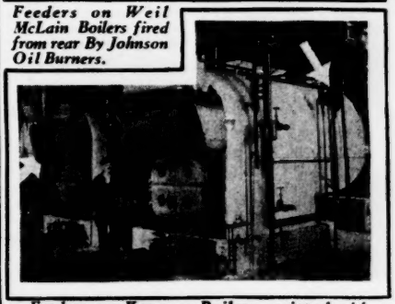
Two Feeders on Pacific Boilers



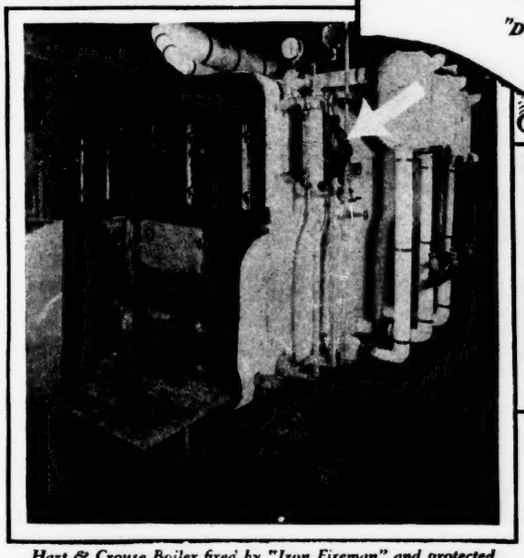
Feeders on Weil McLain Boilers fired from rear By Johnson Oil Burners.



Two feeders on Utica Boilers in Washington, D. C. Apartment Bldg.

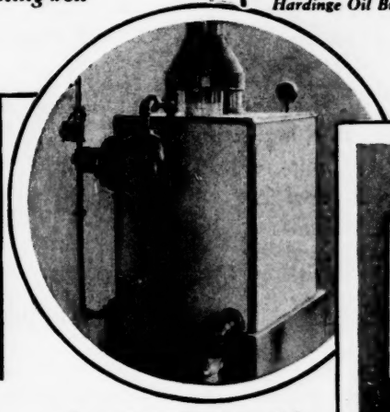


Feeders on Kewanee Boilers equipped with Hardinge Oil Burners.

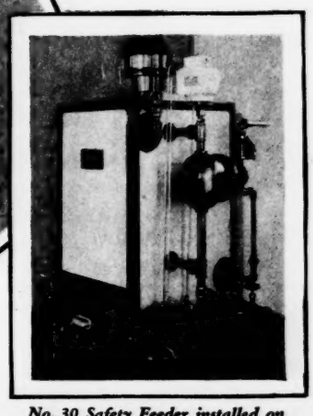


Hart & Crouse Boiler fired by "Iron Fireman" and protected by Feeder.

Feeder in Beier Bakery, Dixon, Ill.—an excellent application.



No. 30 Safety Feeder installed on Bryan Boiler

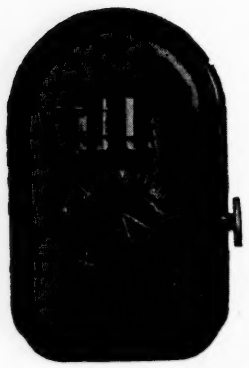


No. 30 Safety Feeder installed on Bas Mor Gas Boiler

Make EXTRA PROFITS

on Unit Heaters
with these
EFFICIENT CONTROLS

The No. 56R Aquaswitch—an exclusive Time-O-Stat control for Unit Heaters.



The No. 64 Thermoswitch—a dependable, high capacity, room temperature regulator, ideal for industrial use.

Whenever you install a Unit Heater, equip it with Time-O-Stat automatic controls. They increase Unit Heater efficiency and *bring you extra profits!*

Unit Heaters equipped with the 56R Aquaswitch build up *quick heat*, never blow cold air, and remain idle at night and over week ends, saving needless expensive operation and wear and tear. Even though the room thermostat calls for heat, the 56R Aquaswitch does not allow the fan to operate unless the coil has reached a predetermined temperature.

Combined with the No. 64 Thermoswitch it provides *complete automatic control* — assures efficient operation of all types of Unit Heaters.

Unit Heater controls are an important part of Time-O-Stat's famous line of automatic controls . . . All have been perfected in Time-O-Stat's research laboratories. They form the most dependable line of automatic controls for the heating industry . . . For full information on these products, or on any problems of automatic control — write or wire us today!

TIME-O-STAT CONTROLS COMPANY
ELKHART, INDIANA

Branch Offices and Exclusive Distributors in All Principal Cities of the United States.
Canadian Distributors: Toronto and Montreal.

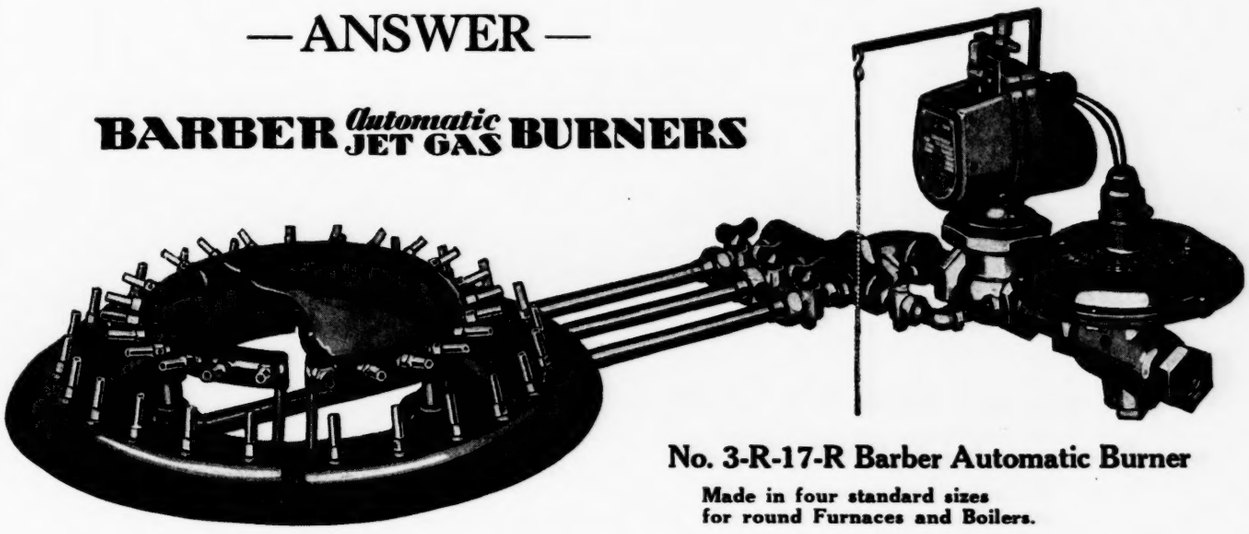
Manufacturers of AUTOMATIC CONTROLS *for Oil Burners — Gas Burners — Coal Burners — Electric Refrigerators — Furnace Fans — Mechanical Stokers — Industrial Ovens — Ice Machines — Unit Heaters . . . . . also of Sign Flashers — Mercury Switches — Electric Heaters — Corrugated Metal Bellows.*

Spring Heating Season

How are your customers going to maintain an even and healthful temperature in their homes?

— ANSWER —

BARBER *Automatic* JET GAS BURNERS



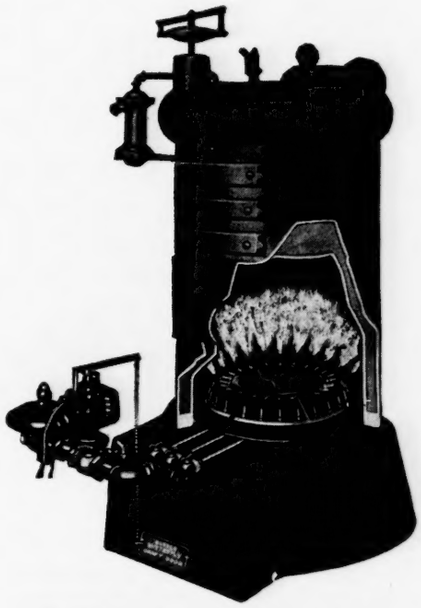
No. 3-R-17-R Barber Automatic Burner

Made in four standard sizes for round Furnaces and Boilers.

Now is the time to tell your customers how they can thoroughly enjoy the beauties of Spring without any thought or worry about maintaining an even, comfortable temperature in their homes. "Try" is the very best they can do when using coal. Cold and windy outside one day or hour, then mild or very warm the next. How are they going to regulate a coal fire to meet these fluctuating weather conditions? It just can't be done.

Gas, the ideal fuel for every month during the heating season, has a decided advantage over other fuels during the Spring season because with automatic control all care and attention are eliminated and a certain savings in fuel cost should result.

Thousands of home owners are going to start using Gas this Spring. They are going to have Barber Automatic Conversion Gas Burners installed because they convert any good coal burning furnace or boiler into an efficient gas heater, and the cost is nominal compared with all new gas-fired equipment. Let us help you get your share of this profitable business. Write today for literature and sales help.



Illustrating the No. 3-R-17-R Barber Automatic Burner Installed through the clinker door opening of a round boiler.

***The* CLEVELAND GAS BURNER & APPLIANCE CO.**

Burner Specialists

3702-04 Superior Avenue, Cleveland, Ohio

Residence Group Heated by a Webster Type "R" System of Steam Heating

Another Opportunity for Preferred Business

This group of small houses is heated by a central plant Webster Type "R" System of Steam Heating—a practice growing steadily in favor. The arrangement relieves the individual occupant from the entire care of the boiler—a strong talking point for real estate salesmen. Though the Type "R" System is highly engineered, its installation is simple and easy. Its operation is also simple and does not require the services of a skilled operating engineer.

The Type "R" System is well adapted to small groups of residences such as this. Experience has proved it to be economical and completely satisfactory. The safe and sound principle of gravity operation with positive equalization of pressure *plus* the dependable performance of Webster equipment make the Type "R" System remarkably free from trouble and complaints.

When bidding on small house groups with central heat, suggest the Webster Type "R" System. Get in touch with a steam heating specialist in the nearest Webster Branch Office. He will help you in developing this kind of *preferred* business.

-since 1888 Webster Systems of Steam Heating

The Webster Steam Heating Specialist in your vicinity can probably help you in developing *preferred* business with Webster Type "R" Systems. Get in touch with him.

WARREN WEBSTER & COMPANY
CAMDEN, NEW JERSEY

Pioneers of the Vacuum System of Steam Heating

Branches in 52 principal U. S. Cities
In Canada—Darling Bros., Ltd., Montreal

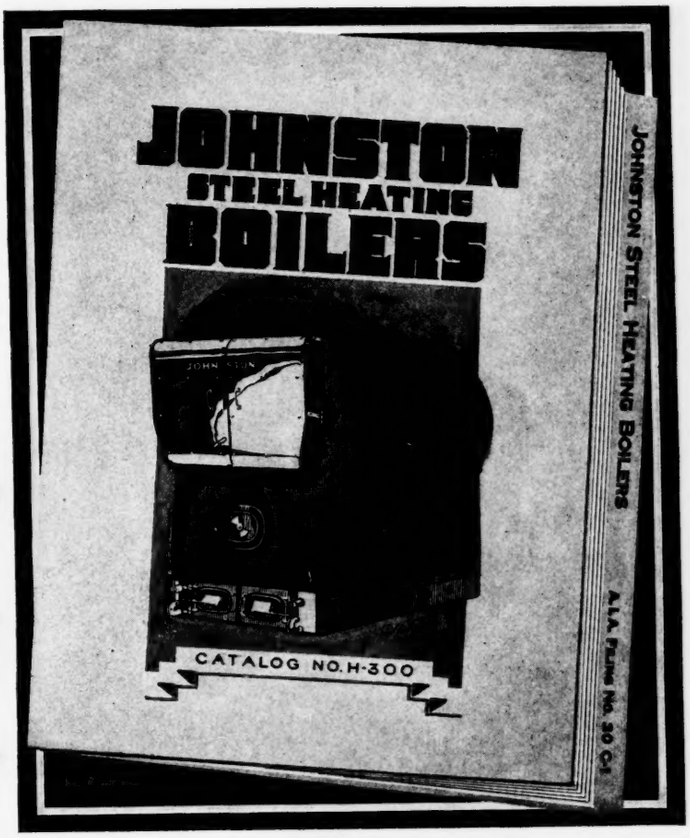
a R-15HC

WARREN WEBSTER & COMPANY, Camden, New Jersey
Please mail Bulletin B-600, describing the Webster Type "R" System of Steam Heating to

Name..... Street..... City.....

HV-3-30

The Johnston Boiler a Quality Product



SEND for your copy of the new Johnston Boiler Catalog

An all-steel heating boiler built up to three rigid standards of quality — durability, simplicity of design, and efficient performance. Tested and proven in actual service in factories, theatres, garages, hotels, apartment houses, and all other types of commercial buildings. Ranging in sizes from 1000 to 20,000 feet capacity. New catalog, just off the press, tells the whole story. Write us on the coupon where to send your copy.

JOHNSTON BROS., INC.
FERRYSBURG, MICH., U. S. A.

JOHNSTON BROTHERS, INC.
Ferrysburg, Mich.

Send copy of your new catalog H-300

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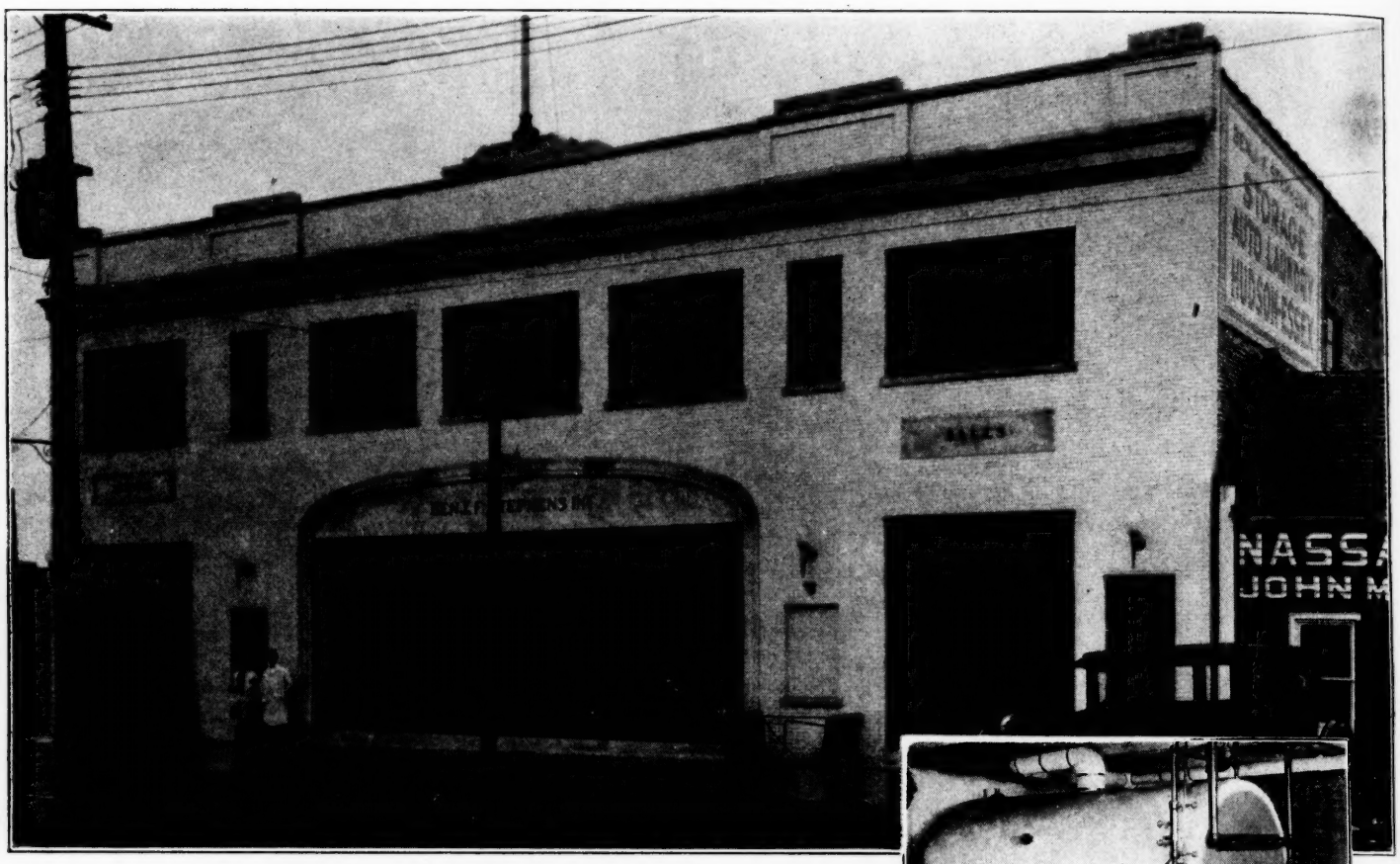

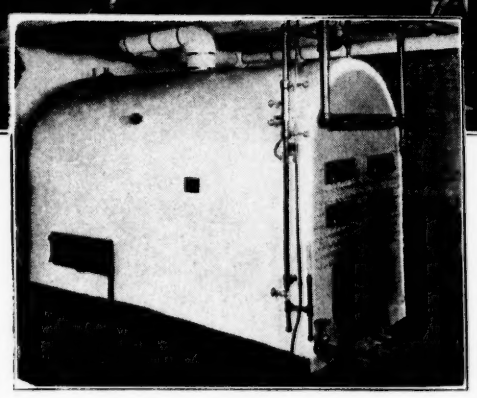

Cost $1.75 Per Day

For a Triple Service Boiler to heat this 80' x 139' garage building

Talk about low cost heating economy—here is a Triple Service boiler installed in the Benjamin F. Stephens, Inc., garage at 1274 Flatbush Ave., Brooklyn, N. Y., that's supplying more heat than needed—that furnishes hot water in abundance to wash cars all day long—that disposes of the waste paper, dirty oily rags and other rubbish in the incinerator without odor or a trail of soot and dirt—and this Triple Service boiler consumes only 25 gallons of oil per day at a cost of 7c per gallon.

Think of it. This huge two story building, with its doors wide open all day long in the coldest weather, is kept heated at this trifling cost. Furthermore, a gas burning water heater that was formerly used to furnish the hot water is now lying idle—the operation cost of which alone was greater than the entire cost of operating the Triple Service boiler for heat and hot water.

If a better investment in heat and hot water can be found we have yet to hear of it.

If you are interested in real boiler efficiency for commercial buildings, apartment houses, fine residential homes, you owe it to yourself to investigate Triple Service economies. Will you ask our nearest distributor to tell you more about Triple Service boilers?

INTERNATIONAL BOILER WORKS CO., East Stroudsburg, Pa.

Distributors

THERMO SERVICE, Inc.
New York City, N. Y.
OIL BURNER CORP.
Trenton, N. J.
CHAS. T. KING & CO.
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WARNER PLUMBING & HEATER CO.
Atlanta, Ga.
WILLIAM G. ROBELEN
Wilmington, Del.
HEATING EQUIPMENT CORP.
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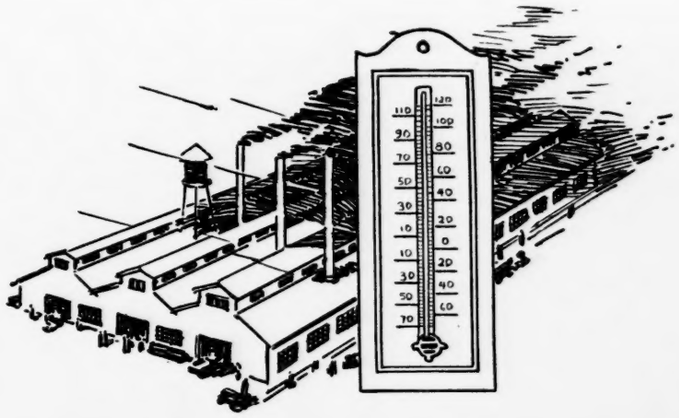
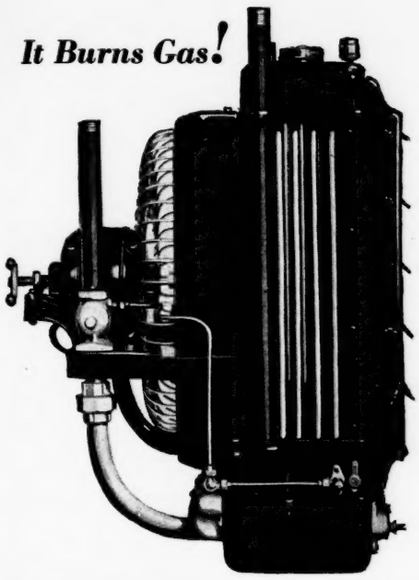
INCINERATOR & ENGINEERING CO., Montreal, Canada.

JAMES A. CONDON, Inc.
Philadelphia, Penna.
Mr. B. FRANK TOUCHSTONE
Lexington, N. C.
AUTOMATIC HEAT CORP.
Jacksonville, Fla.



Don't let weather run your business

It Burns Gas!



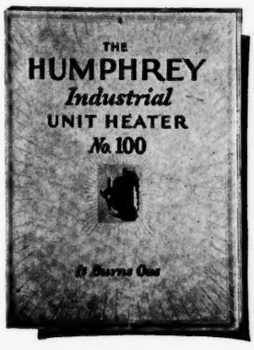
1. Does production drop when the thermometer goes down?
2. Are your present heating facilities "tailored to fit" each change in temperature?
3. Is every bit of heat utilized in your plant?

The first and fundamental step toward all-around production efficiency in any type of plant today is likely to be heating efficiency. Few executives, however, realize the close relationship between these two factors unless they systematically compare their monthly heating records with regular production records over the same period. Then the connection becomes apparent.

If Humphrey Industrial Unit Heaters are suspended at convenient regular intervals throughout a plant, the questions above can be easily answered. For these heaters furnish easily controlled heat that keeps production at a sustained peak even when the thermometer dips low or hesitates around the freezing mark. Production wastes will be lessened when overheated or underheated space is eliminated.

Whether the plant is large and hard to heat, or composed of one cramped room and a workbench, the system of Humphrey Unit Heaters fits the exact needs. It is a flexible system because the number of units can be increased or decreased along with the flow of heat from each individual unit.

When this type of heater is employed, every bit of heat is utilized and well directed. It warms and speeds the producers and their work. The Humphrey Industrial Unit Heater satisfactorily answers the three questions above. Can your present heating system also prove its place?

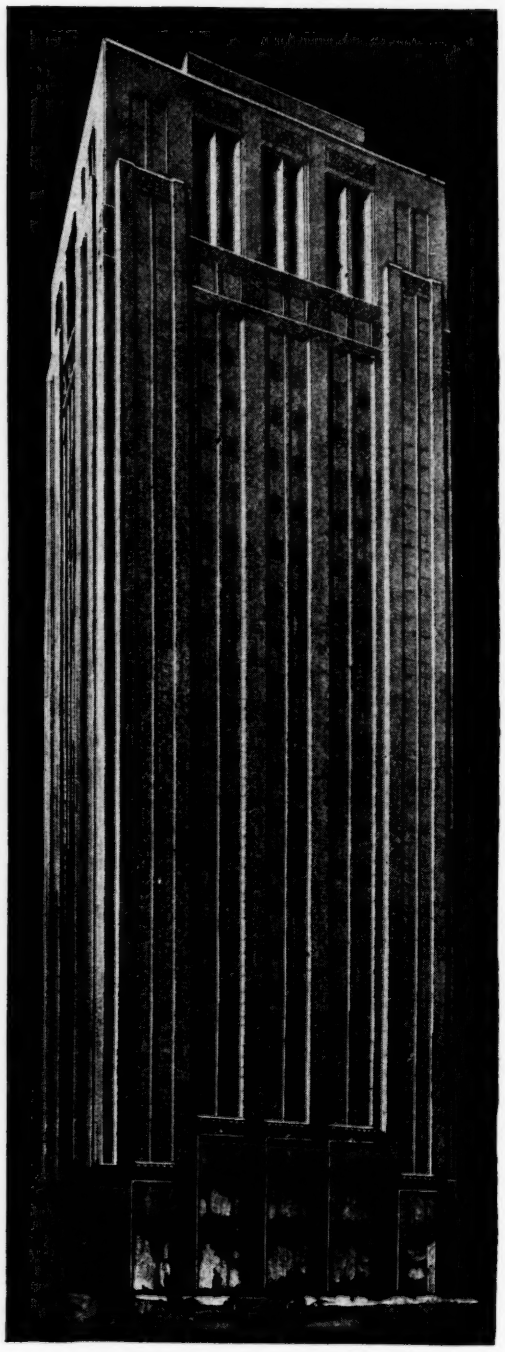


Write for this catalog

GENERAL GAS LIGHT COMPANY, KALAMAZOO, MICHIGAN
44 WEST BROADWAY, NEW YORK 135 BLUXOME STREET, SAN FRANCISCO

The Humphrey
Industrial Unit Heater

ILLINOIS ZONE CONTROL IN THE BUCKINGHAM BUILDING



BUCKINGHAM BUILDING, Chicago
Holabird & Root, Architects
J. A. Sutherland, Consulting Engineer
Kohlbry-Howlett Co.,
Heating Contractors

ILLINOIS HEATING SYSTEMS

IN THIS, one of Chicago's finest and newest office buildings, heat is controlled by Illinois Thermo-Manual Zone Control with seven Master Regulating Valves.

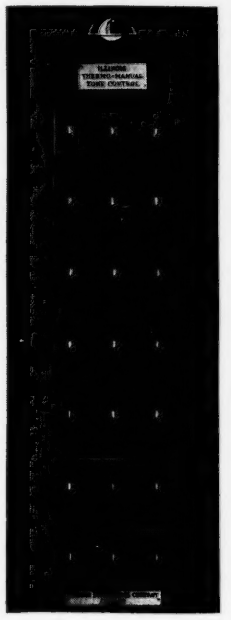
Five valves control the main building—one on each side, North, East, South and West, and one valve for the first floor main. Two valves control the tower section, one on the North and West sides, the other on the South and East sides. Clock type thermostats are located in the corridors of the building for the control of all zones above the first floor. A mercoid thermostat controls the first floor. The panel board is located in the Engineer's office in the basement.

With Illinois Zone Control, only *one* Master Regulating Valve is required to control each zone. The system is *simple*. The pump installation is regular. A separate pump for each zone is not required or recommended. No complicated changes are necessary to install Illinois Zone Control.

Outside temperatures; direction and velocity of the wind; location and intensity of the sun; the number of occupants and hours of occupancy—all are factors that govern the amount of heat required in various parts of a building—and Illinois Zone Control provides for all of these important variables, effecting a remarkable fuel saving.

One report states that during the heating season of 1927-28 with an Illinois Thermo-Manual Zone Control System in operation in a manufacturing plant, the fuel cost was 35.7% less than during the heating season of 1926-27 without Zone Control. Further, the occupants were more comfortable and their efficiency was increased.

To illustrate further what can be accomplished in increased economy resulting from the use of Zone Control, the University of Pittsburgh reports a coal saving of $1,980.00 from the use of two 6-inch and one 5-inch Master Control Valves during the season of 1927-28. In many buildings the installation of Zone Control will save its cost in one heating season.



Seven Unit Thermo-Manual Control Panel for the Buckingham Bldg., Chicago

Control boards are provided to give a clear picture of what each Master Control Valve and Thermostat in a system are doing, and also to give the operator instant individual control of each Master Valve if desired.

The panels are of the unit type. Boards are made up with one panel for each Master Valve installed up to seven panel boards as illustrated.

Partial List of Users of Zone Control Valves

Dartmouth College
Bates College
University of Pittsburgh
Oliver Building, Pittsburgh
Farmers National Bank, Pittsburgh
Alaska Building, Seattle
Republic Building, Seattle
L. C. Smith Building, Seattle
Orthopedic Hospital, Seattle
Ligget Building, Seattle
Northern Life Building, Seattle
Central Mfg. District, Chicago, 43 Zone Valves
B. & M. R. R. Terminal Bldg. Boston

Write for Bulletin No. 61

REPRESENTATIVES IN 40 CITIES OF U.S.A.

ILLINOIS ENGINEERING COMPANY

ROBT. L. GIFFORD President INCORPORATED 1900

CHICAGO

Matched Frame Ball-Bearing Motors!

BALDOR has added another feature of special advantage to makers of motor driven equipment . . . matched frame motors . . . in which the whole assembly except punchings and windings is identical for all motors of a given rating and speed.

Baldor *Ball-bearing* Motors completely eliminate the thrust and lubrication problems of sleeve bearing motors.

Baldor Motors will run much longer [2 to 5 years] without lubrication attention than the sleeve bearing types.

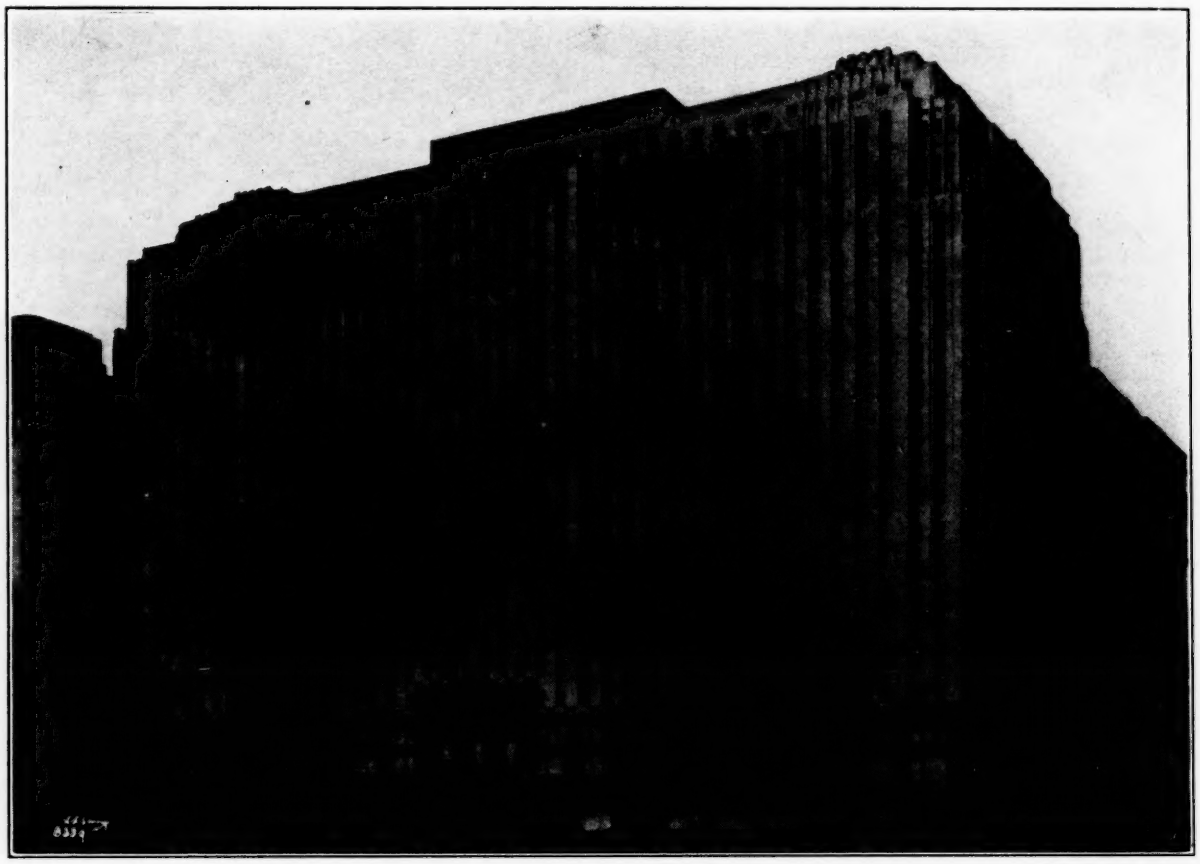
Specializing for 10 years in ball-bearing designed motors, Baldor has brought its line to a perfection that cannot be reached except through such long experience. Ask for folder.

Baldor Electric Co.
4356a Duncan Avenue
St. Louis, Mo., U.S.A.

Single phase Polyphase Direct current Condenser

Matched frame motors in windings for all standard and special current characteristics, with bases for flat mounting or round stator for ring mounting. Open or totally enclosed.

BALDOR
A BETTER MOTOR



PENNA. RAILROAD STATION AND OFFICE BUILDING
Broad Street, Philadelphia, Pa.

Graham, Anderson, Probst & White, Chicago, Ill., Architects

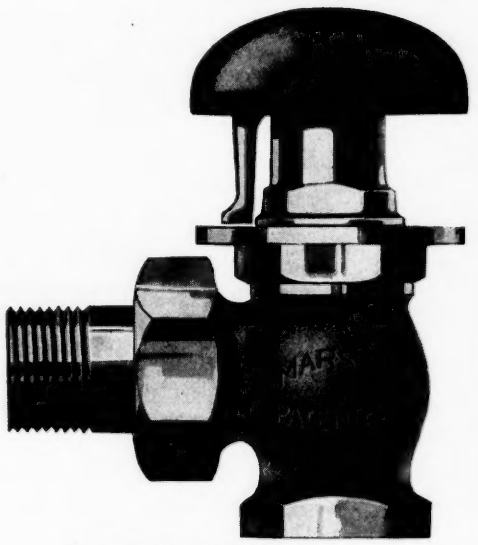
Jas. Stewart & Co., Inc.
New York City, N. Y.
General Contractors

Riggs, Distler & Co.
Baltimore, Md.
Heating Contractors

MARSH CONE DISC MODULATED VALVES

Fig. 147

used throughout on this job



Cone Disc Modulated Fig. 147

MARSH VALVE COMPANY

DUNKIRK — **NEW YORK**

General Sale Distributors

Edward T. Hetherington
1709 Sansom St., Philadelphia

Appleton & Liptrott, Inc.
1480 Broadway, New York

John W. Mabbs
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UNITED STATES RADIATOR CORP'N
General Offices: Detroit, Mich.

SARCO COMPANY, Inc.
183 Madison Ave., New York

Taylor-Forbes Company
Canadian Agents Guelph, Ont.

Our Contribution
to the art of Heating & Ventilation

SIX YEARS AGO when the Herman Nelson light weight, compact, indestructible radiator was placed on the market, it was immediately accepted as the greatest advance in the art of Heating and Ventilation in a generation. It has made possible heating and ventilation dependability and performance hitherto unattainable. The Herman Nelson Wedge Core Radiator is an exclusive feature of all Herman Nelson Heating and Ventilating Products and accounts for their unequaled performance.

HEATING · VENTILATING · COOLING · DRYING · CONDENSING

UNIVENT

for the ventilation of schools, hospitals, offices and other buildings presenting an acute ventilating problem.

HERMAN NELSON
Invisible
RADIATOR

... supersedes all previous radiators, radiator cabinets or enclosures. Occupies no room space and makes possible any desired decorative scheme or furniture arrangement. Indestructible in service.

THE HERMAN NELSON
hiJet
HEATER

It operates at steam pressures from 1 to 150 lbs., and offers the better and more economical way of diffusing heat in Factories, Railroad Shops, Roundhouses, Mills, Warehouses, Garages, Gymnasiums and Industrial Buildings.

Herman Nelson Radiator Sections
for Blast Heating and Cooling

Indestructible, operating at any steam pressure from 1 to 150 lbs., non-corrosive and leak-proof.

May be arranged in banks to solve any special problem of heating or cooling.

THE HERMAN NELSON CORPORATION · *Moline, Illinois*

Builders of Successful Heating and Ventilating Equipment for over 20 Years

Sales and Service

BELFAST, ME.	UTICA	SCRANTON	SAGINAW	CINCINNATI	DES MOINES	ST. LOUIS	DALLAS	DENVER	SEATTLE
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PROVIDENCE	PHILADELPHIA	CHARLOTTE, N. C.	CLEVELAND	INDIANAPOLIS	GREEN BAY	ATLANTA	EMPORIA	SPOKANE	VANCOUVER
NEW YORK CITY	WASHINGTON, D. C.	GRAND RAPIDS	COLUMBUS	CHICAGO	MINNEAPOLIS	MEMPHIS	KANSAS CITY	PORTLAND	TORONTO
									WINNIPEG, MAN.

Univent *and* Glass *make the difference*

To the trained engineering mind

it is clear that Univent *results cannot be duplicated*

THANKS largely to the engineering profession, the Univent and its basic principle have gained nation-wide acceptance. With acceptance and success has come widespread imitation. There are, today, numerous machines which stimulate the Univent.

But one fact remains: where the layman might, for a time, be confused—the seasoned engineer, trained in investigation, sees clearly that Univent results are due to exclusive features of the Univent. They are results which cannot be duplicated.

The Univent is a complete individual ventilation machine built by an organization of specialists in heating and ventilating equipment. It draws air direct from out-of-doors, cleans it, warms it to a comfortable temperature, and silently delivers it throughout the room with agreeable air motion, but without drafts.

Let us tell you of results being accomplished through Univent Ventilation in schools, office buildings, banks, hospitals, and similar buildings. Write for engineer's edition of "Univent Ventilation." The Herman Nelson Corporation, Moline, Illinois.

No other ventilator gives

UNIVENT (TRADE MARK)

VENTILATION

M-53

MERCOID FURNACE FAN CONTROL

NOTE:—
The "High" and "Low" Double Adjustment and Duct Temperature Indicator, in Plain View.

Announcement

The Mercoid Corporation announces that through their license, under patent reissue No. 15,531, the trade is assured full protection to use their Furnace Fan Control M-53 for any and all Furnace Fan applications.

Write for bulletin A-5 which fully describes the construction and uses of this control.

USE MERCOID CONTROLS FOR ALL UNIT HEATER APPLICATIONS

Mercoid Thermostat

The Mercoid Thermostat is well known for its unfailing performance and is extensively used with various makes of unit heaters. It controls the motor directly where the normal working load does not exceed 10 amperes at 110 volts or 5 amperes at 220 volts. As a pilot switch, where used in series with the proper starting switch, the Mercoid Thermostat will automatically control motors of the largest size.

Complete Catalog Sent Upon Request—Address Dept. H

THE MERCOID CORPORATION

564 WEST ADAMS STREET, *Chicago, Illinois, U. S. A.*

25 CHURCH STREET *New York, N. Y.*

1129 FOLSOM STREET *San Francisco, Calif.*

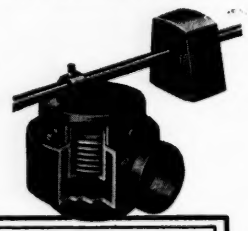
CONTROLS

ON EVERY STREET..

Thrush Electric Circulator

This scientifically designed Electric Water Circulator for home heating plants is the heart of the New Thrush System of Accelerated Circulation Hot Water Heating.

This system also provides automatic control of dampers, automatic refilling of boiler, automatic relief of excess pressures and makes the system a Closed System with increased heat transmission and reduced fuel consumption.



H. A. THRUSH & CO.
Dept. A, Peru, Ind. .....19...

Please tell me more about the new Thrush System of Accelerated Circulation Hot Water Heating.

Name .....

Address .....

there are dozens of prospects for this *Better Heating!*

NOW is the time to *go after new business with Thrush System.* Your prospects, after battling with inefficient heating and paying excessive coal bills all winter long, will listen to the story of this *better* heating system which can be applied to old or new heating plants effectively and inexpensively. You can prove that it *will quickly repay its cost in fuel saving, added comfort and convenience.* Write for full information or ask your jobber about it.

H. A. THRUSH & CO.
Peru, Indiana

THRUSH SYSTEM

ACCELERATED CIRCULATION HOT WATER HEATING

Specify WALWORTH

C.N.I.

CAST PIPE *for*

● Where permanency of installation is a factor of importance, as in drainage lines, vents and underground lines, Walworth C.N.I. pipe offers unique advantages. ● It has the long enduring life of cast iron, yet can be cut and threaded on the job and made up tight with the usual hand tools. ● And when it's in, it stays for years and years, leak proof and corrosion proof.

● Send for the C.N.I. Pipe Manual. ● It tells where we recommend the use of C.N.I. pipe—and, with equal frankness, where we do not recommend it.

Threaded for SCREWED COUPLING

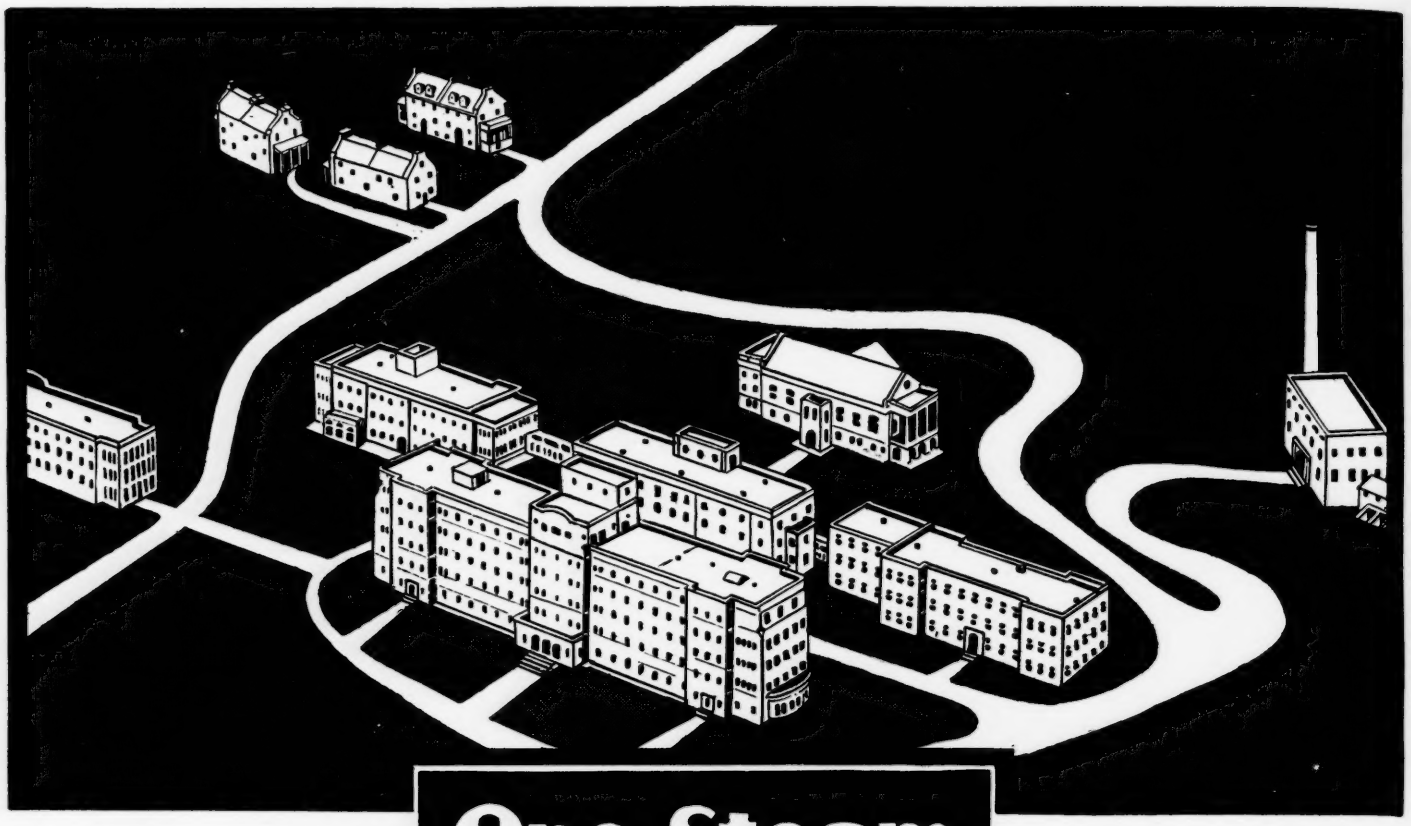
GROOVED for VICTAULIC COUPLING

BEVELED for FIELD WELDING

Regularly made up in 5-foot lengths or in two or more welded lengths. Available in 1½"-2"-2½"-3"-4"-5" and 6" sizes.

WALWORTH

Walworth Company, General Sales Offices: 51 East 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa.; and Attalla, Ala.
Walworth Company Limited, 620 Cathcart St., Montreal, P. Q.
Walworth International Co., 11 Broadway, New York, Foreign Representative
. . . Distributors in Principal Cities of the World . . .



One Steam Plant Instead of Seven

CENTRAL pumping stations and water supply have replaced the individual well.

Central electric plants have made obsolete the ancient oil lamp and rendered unnecessary that each factory and building operate its own dynamo.

The same sound economics is pushing the movement toward centralized heat distributed to large or small groups of buildings from one plant. Many blocks of commercial structures, clusters of factories under one ownership or merely neighbors, residence communities, hospital or educational groups—these are learning, each year in increasing numbers, the actual economy and the immense satisfaction of central heating service.

This economy and satisfaction are especially marked where underground distribution pipes are housed in Ric-wiL Conduit. For this conduit gives permanent security against moisture and guarantees an efficiency that is usually well above 90%. Hundreds of miles of Ric-wiL are in efficient use.

Our Engineering Department with 20 years' experience will be glad to cooperate with you in the solution of central heating problems.

THE RIC-WIL COMPANY

1573 Union Trust Building, Cleveland, Ohio

New York Atlanta Boston St. Louis Baltimore Chicago

Originators *of* Waterproof Conduit Filler

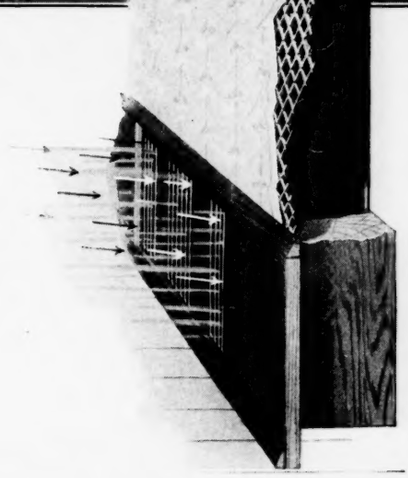
RIC-WIL

UNDERGROUND CONDUIT

YOU need only to know the facts about the Air-Way Aeriet to realize that here indeed is the heating system for which American standards of living have been waiting.

Be honest with yourself and admit that you have never been entirely satisfied with any method heretofore known. None available measured fully up to the other characteristics of modern residence and office architecture. The heating system had not kept pace with the other elements in up-to-date buildings.

Now consider Aeriet. It is wholly concealed within walls or partitions. It projects warmed—not hot—air out into the room at living level, rather than packing heat against the ceiling and forcing it down to where the people are. There are no radiators to clutter up interior arrangements, nor any smudge on the walls.



And what is more important than even this better distribution, is the economy of operation, the simplicity of the automatic thermostatic control, and the ease of installation. There are no service problems.

Aeriet connects to the usual hot water, steam or electric lines. It is a revelation in heat engineering that you will want to learn about. That's easy. Simply use the coupon.

Air-Way
TRADE MARK
AERIET

Please send me the Air-Way Aeriet book.

Name .....

Title .....

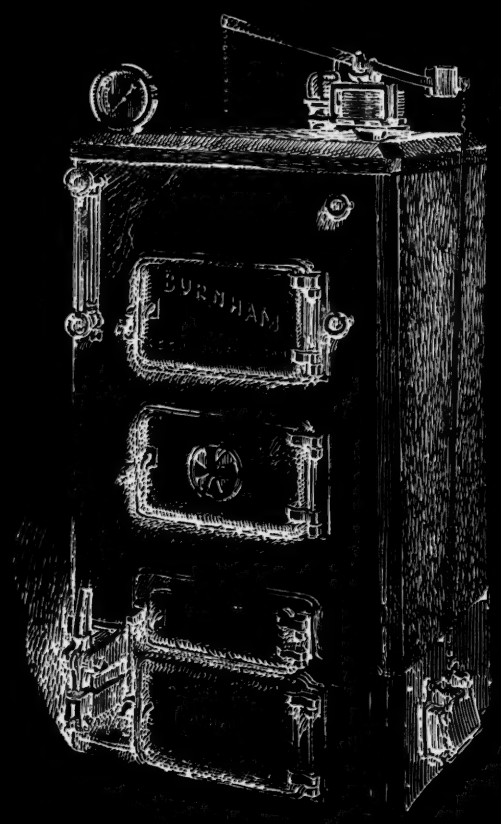
Firm .....

Address .....

H-V

AIR-WAY ELECTRIC APPLIANCE CORP., Toledo, Ohio

HEATING SYSTEMS DIVISION



Now That Economy Counts For So Much

Burnham Boiler's long fire travel counts more than ever. Its long fire travel makes its short coal bill.

P.S.–

This same long fire travel is an additional insurance of economy, when oil is the fuel. It also has a way of muffling down combustion noises.

P.S.–P.S.–

There's a booklet called Letters To and Fro that tells of eight people's successful solution of eight separate home heating problems. Send for it.

Burnham Boiler Corporation

IRVINGTON, NEW YORK

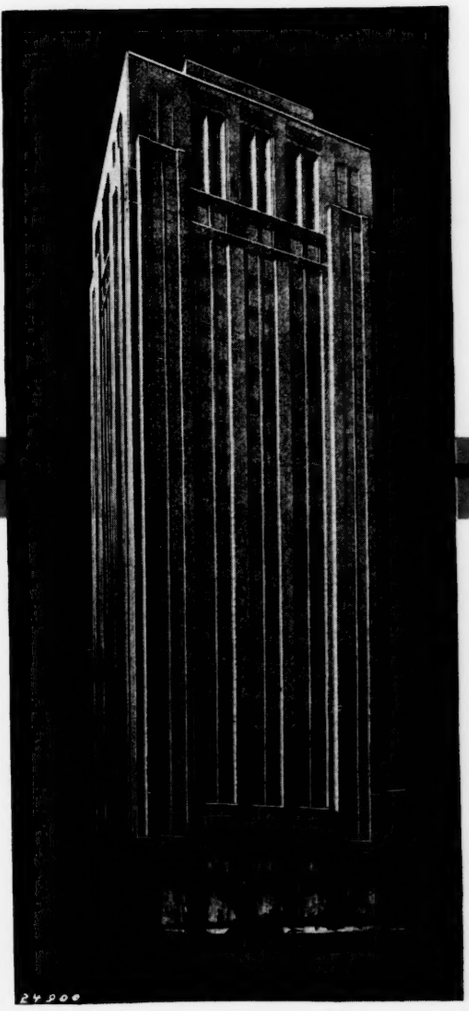
Representatives in all principal cities of the United States and Canada

Buckingham Bldg
Chicago

Architects—
HOLABIRD & ROOT

Builders—
LUNDOFF-
BICKNELL CO.

Plumbing
Contractors—
M. J. CORBOY CO.



ARCO METAL
CAST IRON PIPE

In the Buckingham Building, Arco Metal Pipe gives permanent protection against rust. The owners of the building have learned through experience that ordinary pipe does not last as long as the building itself. Replacement is costly to the owner and inconvenient to the tenant. Modern design demands much piping that is concealed. Permanence in construction is of first importance. Decay must be conquered, repairs must be minimized.

Cast iron pipe is the only safe, durable and economical pipe for building drainage systems, because it is unaffected by the sewer gases and atmospheric conditions.

ALL PLUMBING STACKS FOR WASTE AND REVENT LINES

WILL NOT RUST OUT

Because the iron in Arco Metal Pipe is alloyed with nickel and chromium, its texture is uniform throughout the wall of the pipe, and insures its superior corrosion-resisting qualities either at the bottom of its thread or at any point on its surface. The pipe is of the same dimensions as extra heavy wrought pipe. It can be cut and threaded with standard hand or power tools. It can be welded to any length at the factory or on the job.

Arco Metal Pipe is carried in stock and distributed by jobbers of plumbing, heating and mill supplies.

ARCO · ARCO · ARCO · ARCO · ARCO · ARCO · ARCO · ARCO · ARCO

AMERICAN RADIATOR COMPANY

ARCO METAL PIPE DIVISION
40 WEST 40th STREET, NEW YORK

816 So. Michigan Avenue, Chicago
1294 E. 55th St., Cleveland
1344 Broadway, Detroit
8th and Broadway, Cincinnati
4201 Duncan Avenue, St. Louis

WING FEATHERWEIGHT

LOGICAL HEATING

Heat delivered to the working level first, and diffused uniformly in all directions.

WING Featherweight Unit Heaters are placed as high as possible directly overhead, where the warmest air in the building is found. This is drawn into the intake, reheated and directed downward to the floor level *first,* and all the heat in the building is kept in circulation. Even in buildings with low ceilings Wing Featherweight Unit Heaters mean economy, because their scientifically designed discharges distribute heat uniformly and it is not necessary to overheat some spots to keep the rest of the building comfortable. Our new catalog shows a large number of Wing installations in factory buildings. Write Dept. 3 for it and compare them with your own problem.

Type LC

L. J. WING MFG. CO.

Ventilating Fans, Exhausters, Unit Heaters, Fog Eliminators, Motor & Turbine Blowers

158 W. 14th St., New York City, N. Y.

"Heat with Unit Heaters"

UNIT HEATERS

In the new Worcester Exchange...

the air will be appreciated by operators ... and apparatus, too

The condition of the air is especially important in a telephone exchange. Dust must be kept out. Apparatus must be kept clean if it's to be kept working ... particularly where there are automatic exchanges. And operators appreciate good air, too!

In the Worcester Exchange now being built for the New England Telephone and Telegraph, there are 85 Sturtevant Unit Heater Ventilators censoring the condition of the air. These units draw in air from out-of-doors—*filter it clean of all dust and impurities*—warm it to desired temperature and then pass it into the room noiselessly, safely—without a sign of draft.

Sturtevant Unit Heater Ventilators are compact ... good-looking (in an unobtrusive way) ... and SILENT. They fit into buildings, old or new, without expensive duct work. Typical installations are shown in Catalog 361. A copy? For the asking—from our nearest office.

B. F. STURTEVANT COMPANY

Plants and Offices at: Berkeley, Cal. • Camden, N. J. • Framingham, Mass. Galt, Ontario • Hyde Park, Mass. • Sturtevant, Wis.

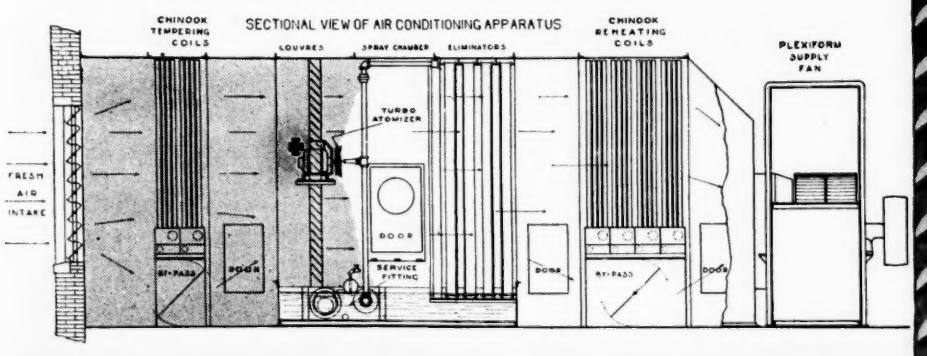
Branch Offices at: Atlanta; Boston; Buffalo; Camden; Charlotte; Chicago; Cincinnati; Cleveland; Dallas; Denver; Detroit; Hartford; Indianapolis; Kansas City; Los Angeles; Milwaukee; Minneapolis; Newark; New York; Omaha; Pittsburgh; Portland; Rochester; St. Louis; San Francisco; Seattle; Washington, D. C. *Canadian Offices at:* Toronto; Montreal and Galt. *Canadian Representative:* Kipp Kelly, Ltd., Winnipeg.

Also Agents in Principal Foreign Countries

Sturtevant Reg. U. S. Pat. Off. *the Silent* **Unit Heater-Ventilator**

SUPPLIES OUTDOOR AIR FILTERED CLEAN AND TEMPERED

FOREMOST *IN ITS Field...*



by *Every* Point of Comparison

THE BAYLEY TURBO AIR WASHER

—non clogging. No fine orifice nozzles to become clogged with entrained solids in the water and cause holes in the water screen.

●

—in place of a bank of fine orifice nozzles; a motor driven centrifugal water sprayer, delivering a water screen the equal of 100 ordinary spraying nozzles.

●

—a single fire type nozzle large enough to permit the passage of entrained solids in the washing water; thus allowing continued use of same water without the use of filters or strainers.

●

—a dense mist screen obtained by directing the water from the single nozzle to a rapidly revolving rotor where it is churned centrifugally into an even, solid spray.

●

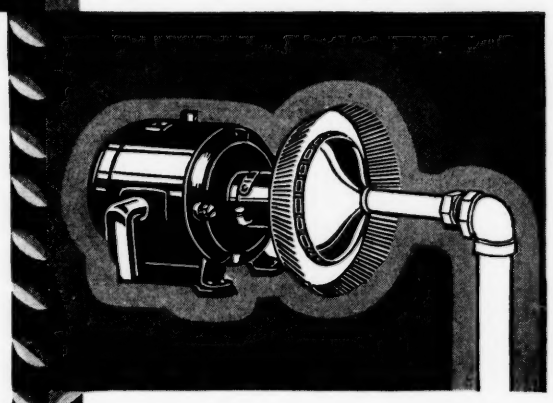
—operates with water at only 7 ft. head at nozzle.

●

—by replacing multiple nozzle banks with Bayley Turbo-Atomizers present inefficient installations of air washers can be made highly efficient.

●

That briefly is the Bayley Turbo-Air Washer. Scores of installations have proven it successful. May we tell you where they are and describe them more fully by means of Bulletin No. 29A.



Above the Bayley Turbo-Atomizer. Plan illustration, shows complete Bayley Turbo Air Washer.

BAYLEY BLOWER COMPANY
742 Greenbush St. Milwaukee, Wis.

Fans — Heaters — Air Washers — Unit Heaters — Heating, Ventilating, Drying, Air Conditioning, Humidity Control, Mechanical Draft.

Bayley

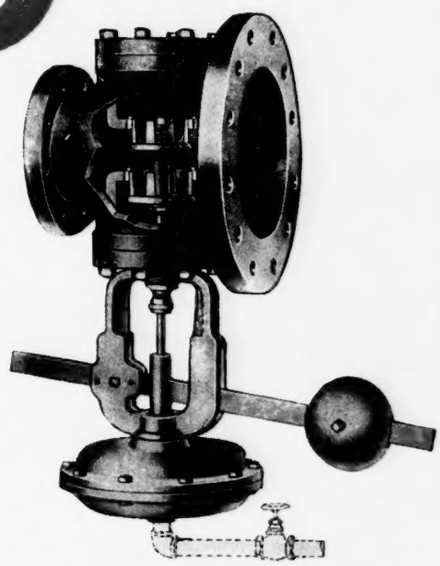
TURBO AIR WASHER

STOP

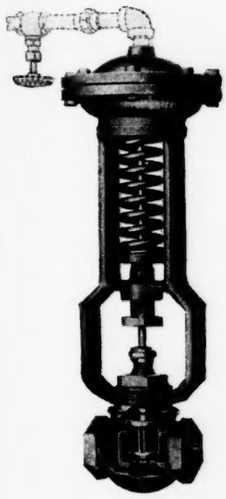
COSTLY *Pressure and Level* VARIATIONS AND LEAKS *with*

McALEAR

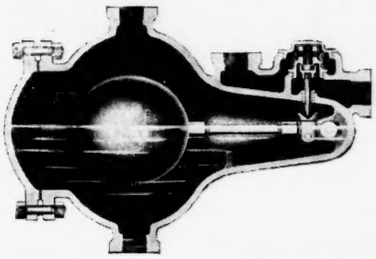
Pressure and Level Controls



REDUCING VALVE
Will control sensitively and accurately for sub-atmospheric pressures or any reduced pressures up to ten pounds. (No. 155)

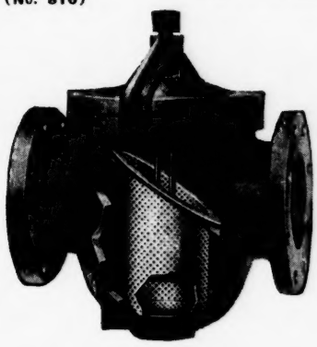


PUMP GOVERNOR
Positive—accurate. Provides constant, uniform pump control.
(No. 425)



WATER FEEEDER
Constructed in several different types—simplex and duplex—for coal, oil or gas fired boilers.
(No. 816)

SUCTION STRAINER
Furnished with clamped or bolted cover. Open or closed basket easily removed for cleaning. (No. 528)



Modern Installations demand the positive action—absolute accuracy and rugged simplicity of McAlear Pressure and Level Controls because their unusual sensitiveness gives a smoothness of plant operation that means higher efficiency and added protection.

The McAlear Line is highly developed to provide the exact Control needed for every condition. It is fully illustrated in our 128-page book with installation diagrams, blue prints, tables, etc. Write for it.

THE McALEAR MFG. CO.
1905 S. Western Ave., CHICAGO, ILL.
Sales Engineers in all Principal Cities

Is your Production Schedule suffering from Hygrosis?

HYGROSIS, or *faulty humidity*, as indicated by the hygroscope, an instrument for measuring the degree of moisture of the atmosphere, cripples production.

Because faulty humidity has a bad effect on your workmen, it makes your production schedule look sick. And if you store, handle, or process materials which are easily effected by moisture, it does still more damage.

Skinner Brothers' Engineers, with years of training and experience in providing correct temperature and air conditions in all kinds of plants under all sorts of conditions, are specialists in heating and air-conditioning problems.

Avail yourself of the services of the Skinner Brothers' Engineer in your city—it will not obligate you in any way. Telephone him today or write direct to Skinner Brothers in St. Louis outlining your problem.

The fans in Skinner Brothers Unit Heaters can be used for cooling in summer.

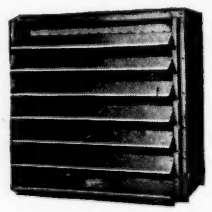
Skinner Bros. Unit Heaters

SKINNER BROS. MANUFACTURING COMPANY, Inc.
1402 S. Vandeventer Avenue, St. Louis, Mo.
Branches in All Principal Cities ***"The Originators of Unit Heating"***

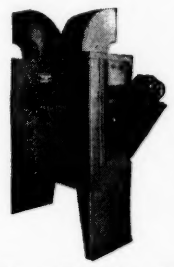
A UNIT HEATER FOR EVERY INDUSTRIAL HEATING AND VENTILATING REQUIREMENT

Skinner Bros. "Baetz Patent" Air Heater

Skinner Bros. Patented Direct-Fired Air Heater

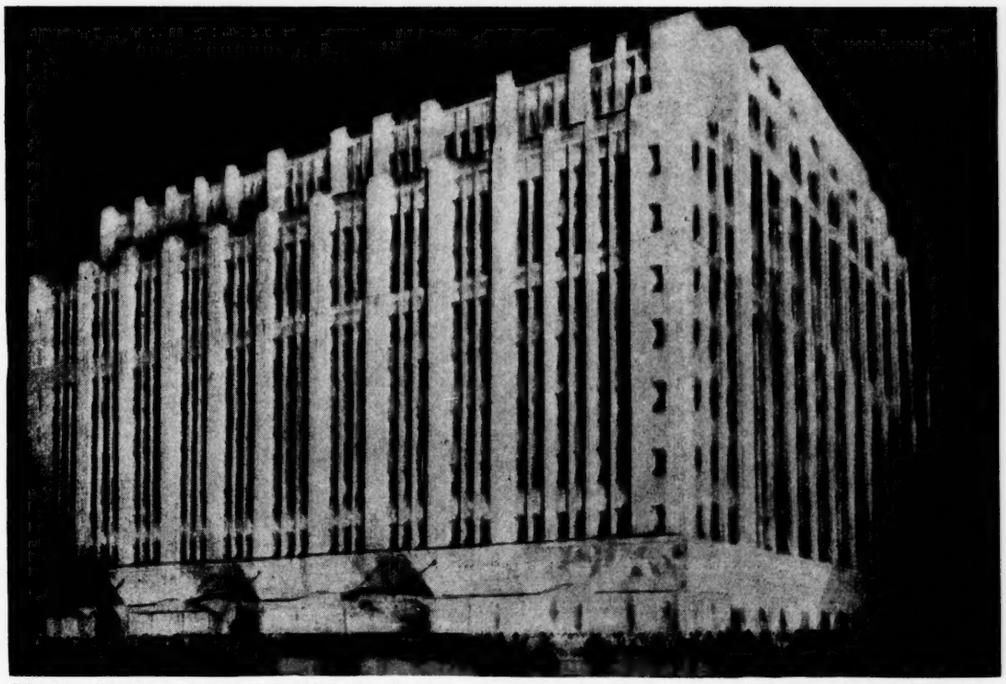


Skinner Bros. Patented "Lightweight" Air Heater

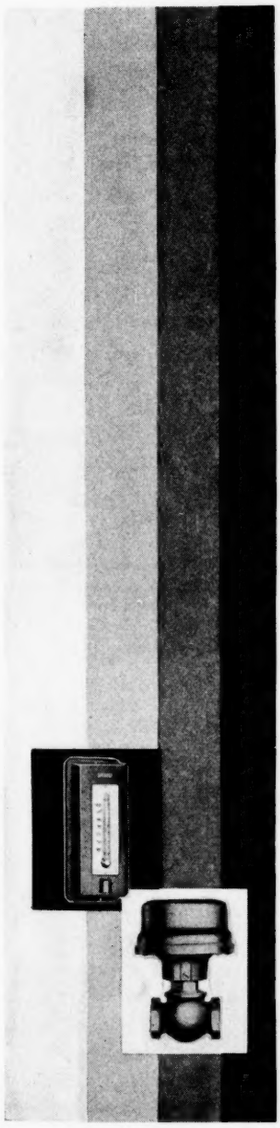


Skinner Bros. Type "U" Air Heater

"In the heart of Brooklyn, on a site long familiar to millions of people, we are erecting one of the most beautiful buildings in America, devoted exclusively to retailing merchandise. The year 1929 will witness the completion of the first unit of a great structure that will eventually cover almost this entire block, a block with the largest frontage in the city" . . . . . from statement by Simon F. Rothschild.



The New Abraham & Straus Building, Brooklyn. . . . From Drawing by Hugh Ferriss - *Arch.* Messrs. Starrett & Van Vleck



A MOST INTERESTING INSTALLATION *of* TEMPERATURE CONTROL

The Johnson System Of Heat & Humidity Control is installed throughout this impressive, new structure, now in its first stage of completion.

Direct radiators are along the outside walls, as usual. Johnson Thermostats, are placed on piers between the radiators, each thermostat controlling from one to two radiators. Parallel with the outside walls, partitions about nine feet high are erected, a passageway thus formed to make easy access for merchandise to all parts of the store. Inside of these partitions, or in the store space proper, Johnson Pilot Thermostats are erected on columns. The branch lines from these Pilot Thermostats supply air to the Thermostats on the outside wall between the radiators, which in turn operate the valves on the radiators in accordance with the temperature requirements in the store space proper, beyond the partitions.

The store's ventilating apparatus is controlled by Johnson Cold Air Thermostats, placed in the cold air inlet duct and operating the diaphragm valve on the first row of the heated coil. Johnson Multiple Thermostats are placed in the fan discharge, controlling the inner rows of the heater coils. Johnson Model Indicators are installed with the ventilating apparatus, operating the cold air inlet and recirculating dampers: so that the supply of cold and recirculated air can be modulated as may be necessary.

The store's vestibules are heated and ventilated with recirculated air: taken from the store, passed through heater coils and delivered into the vestibules. The heating coils here are controlled by Johnson Two-Point Insertion Thermostat, placed in the diaphragm of the fan and operating the diaphragm valves on the heater coil—in conjunction with the pilot thermostat in the main store near the vestibule. If the thermostat at that point becomes too low, the Pilot Thermostat releases air from the Two-Point Thermostat and the full capacity of the heater coils is used for the purpose of heating the vestibule to a temperature sufficiently high to prevent cold drafts in the store space adjacent to the vestibules.

Thus is given another impressive example of the broad utility of Johnson Heat and Humidity Control and the recognized value of Johnson Control on buildings' heating and ventilating apparatus: for maximum efficiency and minimum cost.

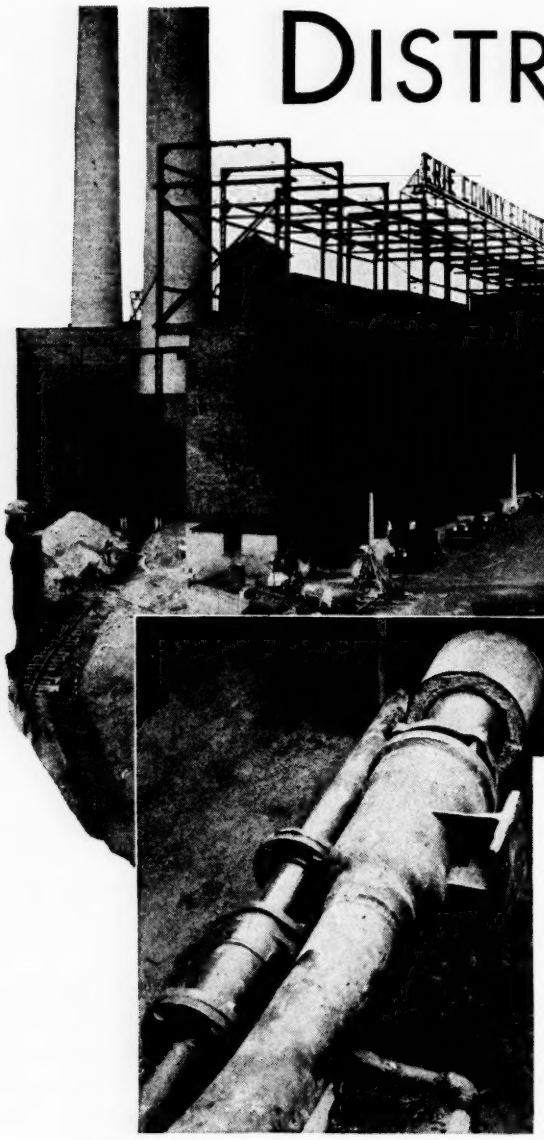
JOHNSON SERVICE COMPANY MILWAUKEE, WISCONSIN

ESTABLISHED 1885

JOHNSON HEAT AND HUMIDITY CONTROL

DISTRICT STEAM HEATING LINES

of the Erie County Electric Co., Erie, Pa., Demonstrate the Efficiency of ADSCO EQUIPMENT



Power plant of Erie County Electric Company and steam supply and return line showing Adsco Expansion Joints.

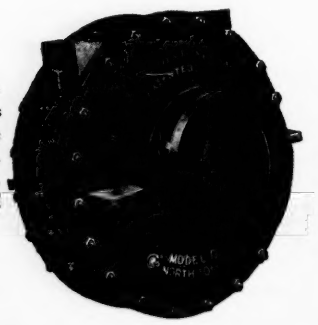
YOU can't go wrong by following the example of those who operate America's largest steam lines, and who have learned from experience what equipment will give long uninterrupted service . . freedom from costly repairs and maintenance.

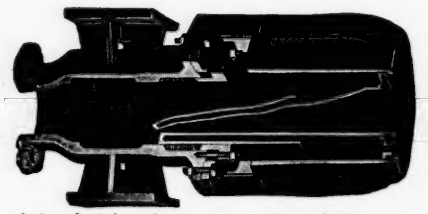
By installing Adsco Equipment, you can make your steam lines as efficient and trouble-free as those of the Erie County Electric Company, Erie, Pa., and 90% of the other large district heating companies, that use Adsco Expansion devices, meters, anchors, guides, etc. Some of this equipment is shown in the illustrations below. All is described on our bulletins which we will be glad to send on request, or can be found in Sweet's Engineering Catalogue.

AMERICAN DISTRICT STEAM COMPANY

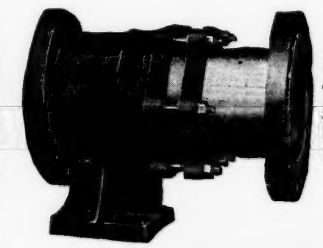
GENERAL OFFICES AND WORKS
NORTH TONAWANDA, N.Y.
OVER FIFTY YEARS IN BUSINESS

(At right) Adsco Double Variator, Model O takes care of 120 ft. of pipe at 50 lbs. pressure. Total traverse 2 3/4". Service outlets and anchor plates.





(Above) Adsco Duplex-Sleeve Guided Expansion Joint. For pressure up to 400 lbs. and temperature up to 750 degrees Fahrenheit. Air-cooled sleeve keeps packing cool, prevents deterioration and maintains tight joint.



(At left) Adsco Semi-Guided Expansion Joint. For 125 and 250 lb. pressure, with 4, 6, 8, 10, 12 inch traverse.

(Above) Adsco Rotary Condensation Meter. Measures condensation and records directly in thousands of pounds.

(At right) Adsco Red Diamond Brand Casing is built up with kiln-dried, tongue and groove staves, lined with XXXX charcoal tin plate and covered with heavy asphaltum. Highly efficient and durable.

(Above) Adsco Roller Guides and Saddle Plates support pipe and permit free movement in expansion and contraction. Also allows complete insulation.

ADSCO
STEAM LINE EQUIPMENT

EXPANSION JOINTS, CASING, CONDUIT, CONDENSATION AND STEAMFLOW METERS AND OTHER SPECIALTIES FOR THE ECONOMICAL DISTRIBUTION OF STEAM

"Superior to any other Ventilation System"

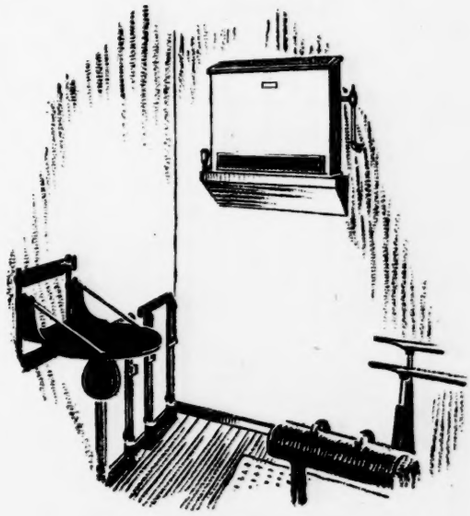
writes New Jersey Architect

"THE PeerVent Unit System has given satisfactory service in *every* installation under my supervision, and is far superior in every way to any other system used for ventilation of school rooms.

"The cost of operation of the unit system has been proved to be less in all instances where antiquated systems were removed for the installation of the PeerVent System. The Unit System is also a great deal cheaper to install and the advantage of having control of each individual class room means much, both in economy and efficiency. The best asset in heating and ventilating to save tax-payers' money is the fact that each room can be controlled individually and there is no need of heating the entire building when required to use one or more rooms in cold weather.

"The PeerVent Unit System has always given the maximum amount of fresh air demanded. *I specify the PeerVent Unit System in all my school work.*"

Most architects know that they can safely specify PeerVent Systems.

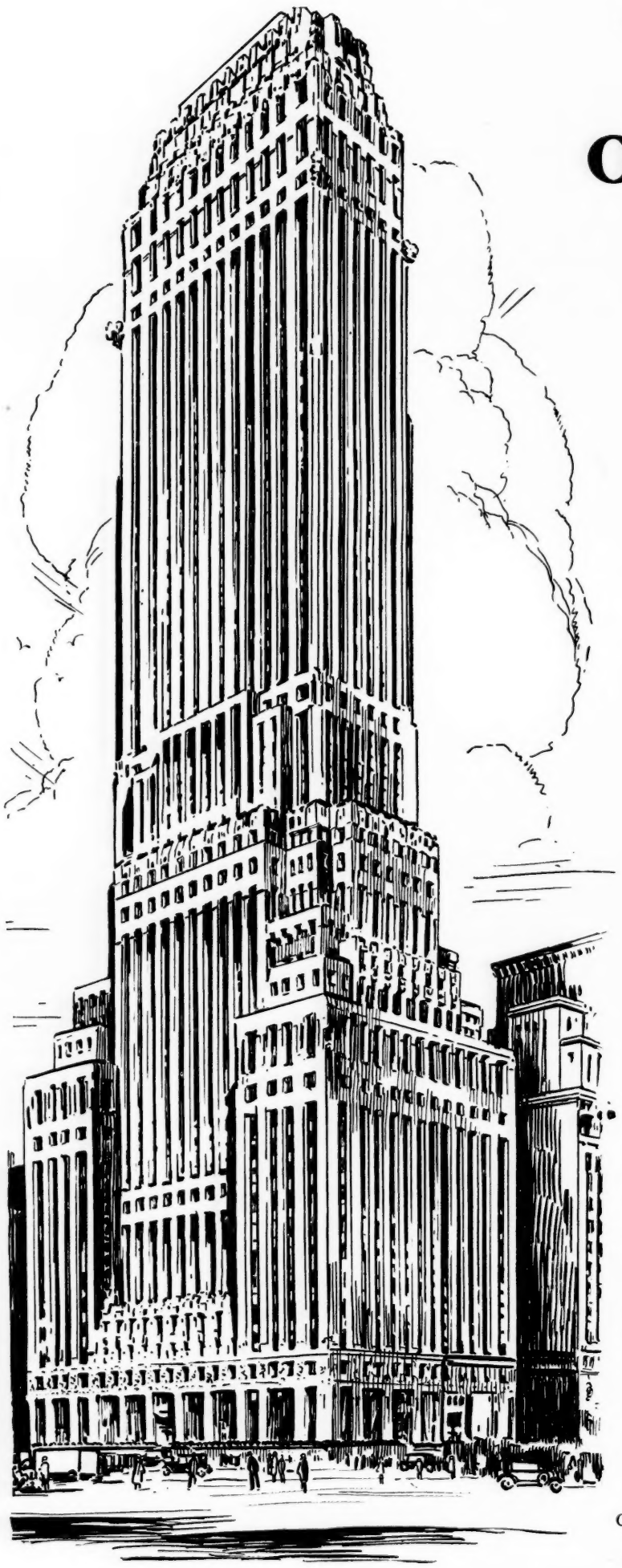


Peerless Unit Ventilation Co., Inc.
Bridgeport, Connecticut
Offices in Principal Cities from Coast to Coast

Pioneers in Unit Ventilation

PEERVENT

Heating and Ventilating Units



"56 floors of Sunlight" ventilated by "Buffalo"

The new Chanin Building at 42nd and Lexington, is in "the heart of the new Architectural and Engineering capital of the world."

Modern in every way, the New Chanin Building is ventilated with Buffalo Fans.

Better buildings, better ventilation—Buffalo Fans.

Buffalo Forge Company
480 Broadway Buffalo, N. Y.

IN CANADA:
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

The Chanin Building
42nd St. and Lexington Ave.

Sloan & Robertson, Architects
Clark, McMullen & Riley, Consulting Engineers
Chanin Construction Co., Builders
Jarcho Bros. & Co., Inc., H. & V. Contractors

They're AIR MINDED *in* HEATING *too —*

To the engineer or student of aerodynamics the advantages of the Modine Heating principle are obvious.

Modine Unit Heaters offer "Directed Heat" —economical, controlled heating.

Suspended from the steam line, 10 to 14 ft. from the floor, Modines deliver heated air down so that it spreads over a wide floor area. As it rises it is picked up, reheated and again circulated down.

Modines are adaptable to all types of space heating. The Stearman Aircraft Corp., above, shows Modine economy of installation. Here, a single steamline and single return are all the piping required. For further information on the economy of Modines, see the following page.

New Catalog 130 now available.
Send for it today.

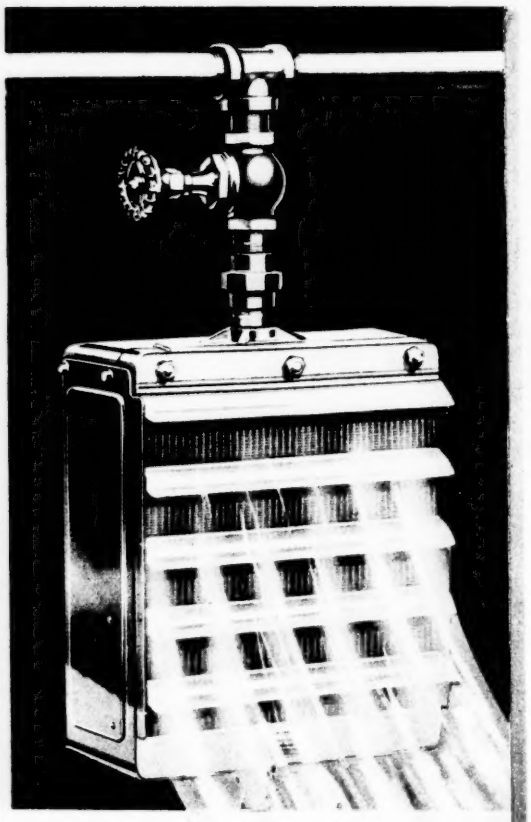
MODINE MANUFACTURING COMPANY

Manufacturers of Unit Heaters
Domestic Copper Radiation » Automotive Radiators
1700 Racine St. (DEPT. A) Racine, Wis.
London Office « S. G. Leach & Co., Ltd. » 26-30 Artillery Lane

Modine *Unit* HEATER

A MODINE *Product*

© 1930, Modine Mfg., Co.



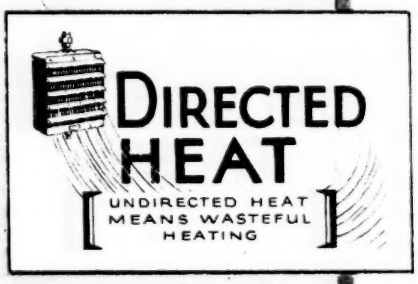
Economy of Installation

NOTE how the Modine Unit Heater is installed—suspended direct from the steamline.

After steam-pipes are run, placing of each Unit is only a 30-minute job for two men. No braces, straps or supports are needed. That means lowest possible installation cost.

And then, Modine Economy has just begun. Every foot of floor space remains available for productive use. Each Unit, individually controlled, is operated only as required. With the quicker, more efficient distribution of heat, the morning warming up period is cut in half.

An exclusive patented feature of Modine Unit Heater construction is the method of suspension. Steam supply and return lines are at the axis of weight. By simply loosening two unions a Modine Unit may be faced in any direction desired to meet changing conditions. Modines cost less to install and less to operate. They are built to last.



Let us give you further facts in our new Catalog 130. Write today.

MODINE MANUFACTURING COMPANY

Manufacturers of Unit Heaters
Domestic Copper Radiation » Automotive Radiators
1700 Racine St. (DEPT. A) Racine, Wis.
Branch offices in all large cities
London Office « S. G. Leach & Co., Ltd. » 26-30 Artillery Lane

Modine Unit HEATER

A MODINE Product

FIGURE THIS SAVING

A typical example of fuel economy

The Prairie Oil & Gas Co. office building at Independence, Kansas, is now heated with a Dunham Differential System, a change-over of the previous system. Direct comparison of "before and after" costs of gas fuel shows a 33.4% saving effected by Differential Heating.

Another example in a 40 story office building

The superintendent of the Barlum Tower, Detroit says, "The Differential System solved two great problems of operating our large heating system—(a) satisfactory heating, (b) reasonable cost. Fast circulation and efficient heating save an average of 1½ hours on the heating-up period each day."

FOR YOUR OWN HEATING NEEDS

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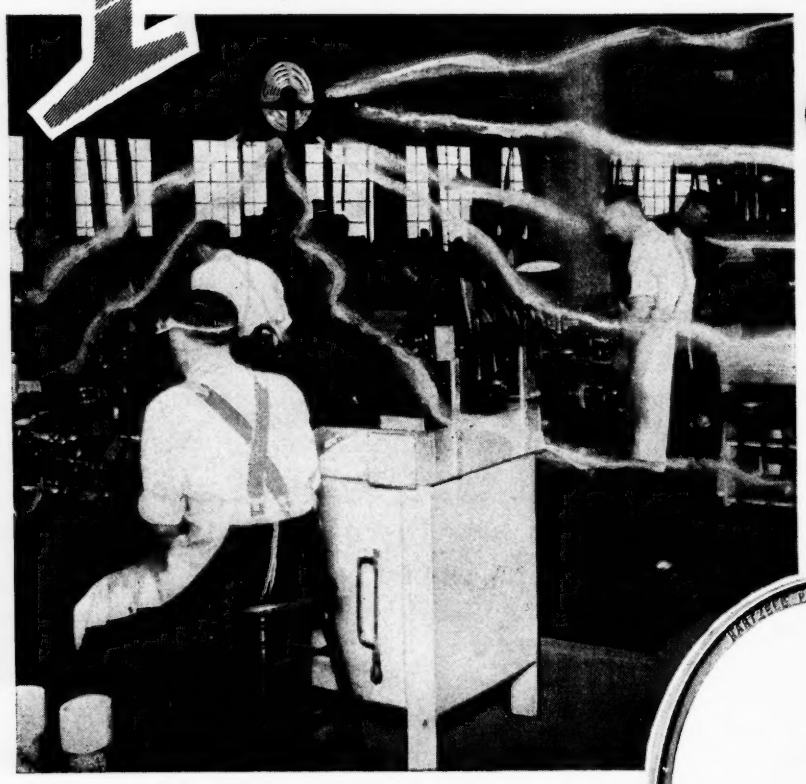

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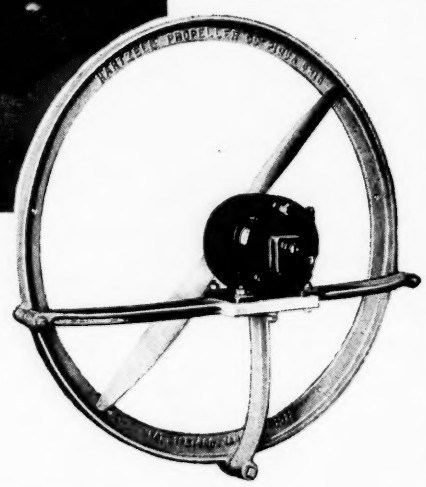

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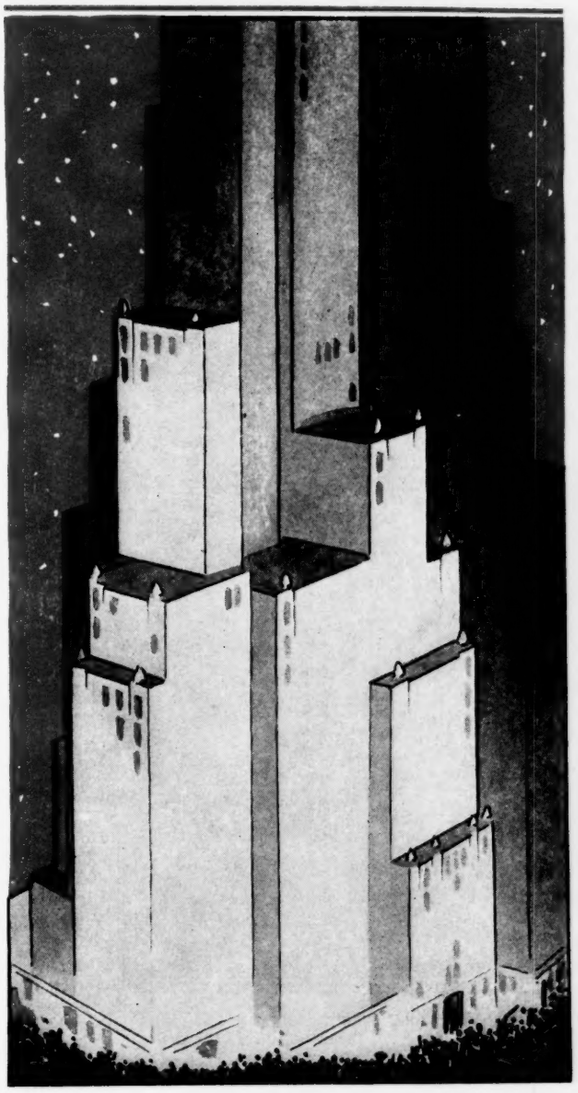

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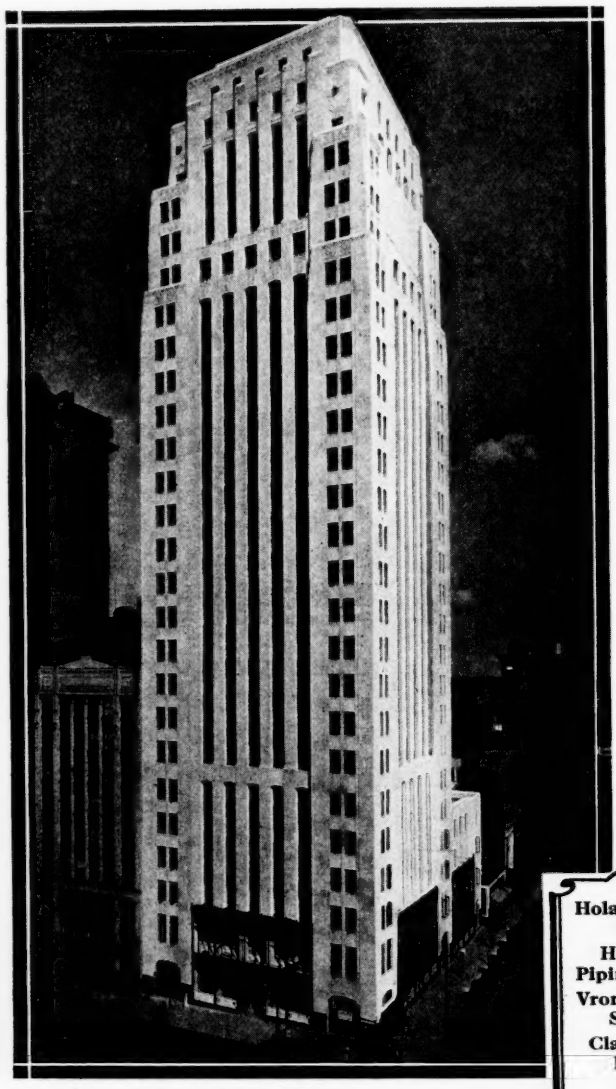

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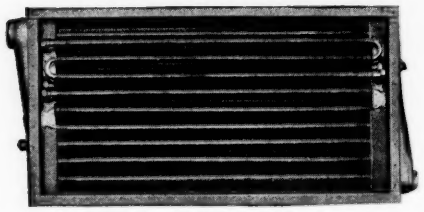

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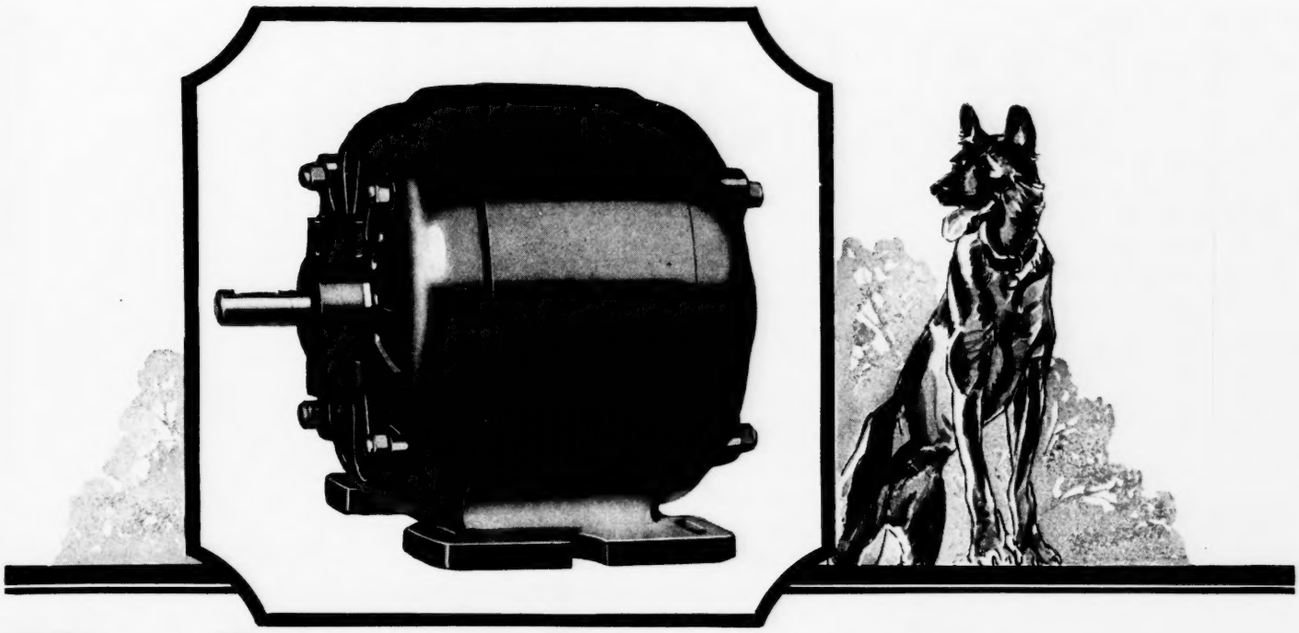

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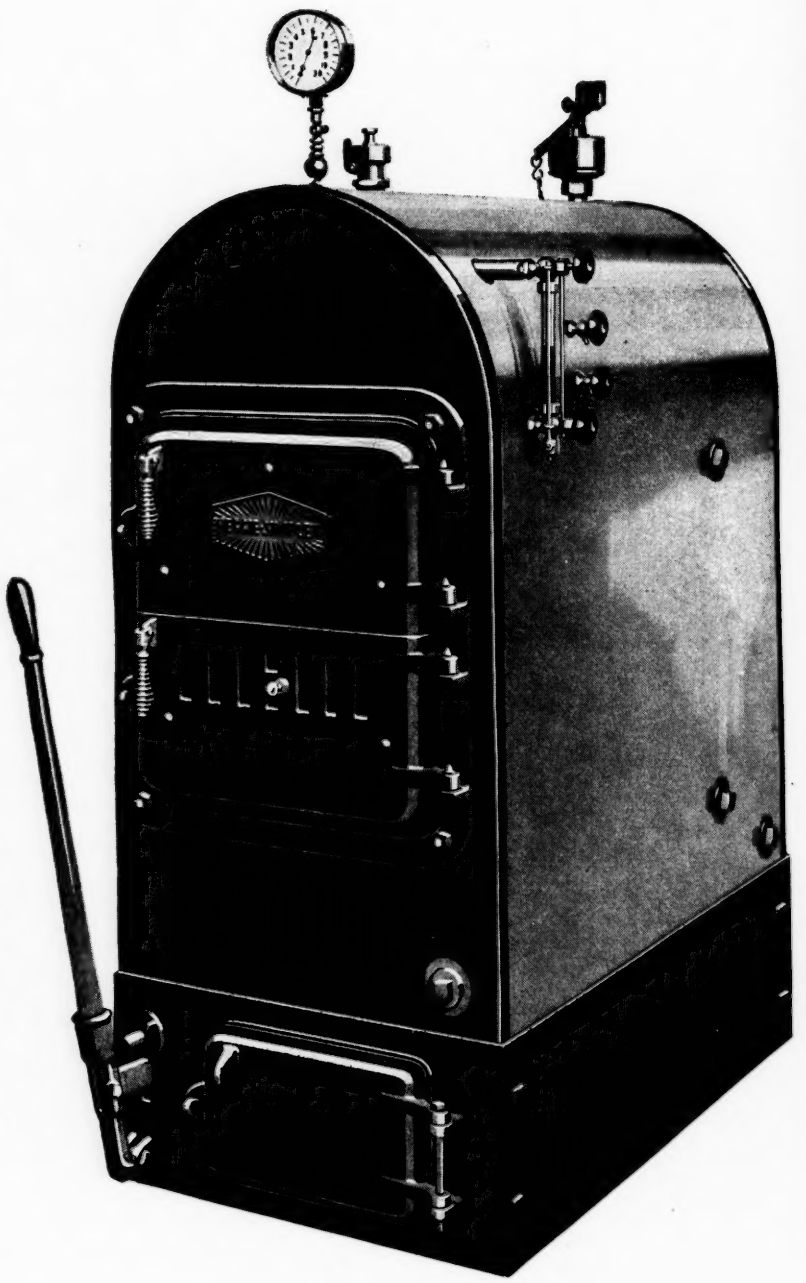

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HEATING AND VENTILATING

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Contents of previous issues of HEATING AND VENTILATING *can be found by consulting the Industrial Arts Index at the nearest library.*

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VOL. 27 **NO. 3**

The Field of Heating and Ventilating

"OUTDOORS you reach all the people," reads a slogan advocating billboard publicity. Very true, and splendid for the man who wants to reach "all the people." However, a specialized journal like HEATING AND VENTILATING achieves its purpose when it reaches the men who constitute the industry of heating and ventilating.

At the Heating and Ventilating Show in Philadelphia last January, the displays presented a comprehensive picture of our field. They fell naturally into eight groups. Here they are:

Heat-Generation Group—Boilers, warm-air heaters, oil and gas burners, stokers, grates, etc.

Heat-Distribution Group—Steam, vacuum, vapor and water heating specialties, radiators, cabinet and concealed heaters, pumps, traps, valves, piping, fittings, expansion joints, etc.

Air Group—Fans, blowers, unit heaters, air-conditioning, cooling and humidifying equipment; air filters, unit ventilators, ventilators, registers, grilles, etc.

Control Group—Instruments and appliances for indicating, controlling or recording temperature, pressure, volume, time, flow, draft or any other function to be measured.

Central and District Heating Group—Apparatus and materials, especially designed or adapted to central or district heating.

Insulating Group—Building insulation, weatherstripping, boiler, pipe and conduit covering, etc.

Auxiliary Group—Motors, belts, sound-deadening materials, tools, welding and cutting apparatus, etc.

Miscellaneous Group — Water heaters, electric heating equipment, boiler compounds and liquids, etc.

A. S. Armagnac

HEATING AND VENTILATING, formerly The Heating and Ventilating Magazine, is published monthly by Building Division, National Trade Journals, Inc., 521 Fifth Avenue, New York, N. Y., publishers of The Architectural Forum, Building Age, Building Material Marketing, Good Furniture and Decoration, and National Builders Catalog.

H. J. Redfield, Chairman of the Board and Treasurer; Howard Myers, President and General Manager; John Thomas Wilson, Vice-President; James A. Rice, Vice-President; C. Stanley Taylor, Vice-President; Henry J. Brown, Jr., Secretary.

Editorial and Publication Office, 521 Fifth Avenue, New York, N. Y. Branch offices: Chicago, 75 East Wacker Drive, Telephone Randolph 0743; Pacific Coast and South, Blanchard-Nichols-Coleman, Los Angeles, San Francisco, Seattle, Atlanta.

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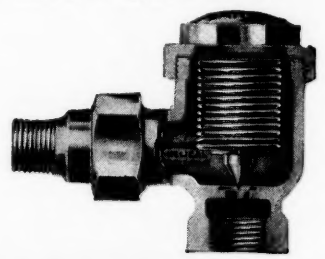

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HEATING AND VENTILATING

Editorial

AS we go to press, members of the A.S.H.V.E. are balloting by mail on the "Recommended Revision of the January, 1929, A.S.H.V.E. Code for Rating Steam Heating Solid-Fuel Hand-Fired Boilers." Whichever way the vote goes it is evident that the society is face to face with one of those crises which seem to arise periodically in its affairs. This time the crisis has been precipitated by the steel heating boiler manufacturers who have adopted a code of their own for the rating of low-pressure heating boilers, and now have gone on record as expressing their disapproval of the proposed A.S.H.V.E. code on the grounds, first, that it provides a multi-rating, rather than a one-number rating; second, that it establishes ratings based upon performance tests, rather than upon physical dimensions; third, that it is intended primarily for cast-iron boilers, while ignoring the characteristics of steel heating boilers and the conditions under which they are sold.

As one steel boiler manufacturer expressed it, "this proposed amended code represents the desires of a large proportion of the cast-iron boiler manufacturers in that it requires only performance data, with no limitations except that of moisture in the steam. Further, it does not require any catalog data covering heating surface. Steel heating boilers, however, for many years have been rated on a ratio between heating surface, grate surface, and rated capacity, and no steel boiler ever is sold on performance data alone. The proposed amended code in no way attempts to meet the views of the steel heating boiler manufacturers as expressed to the A.S.H.V.E. code committee; this is evidenced by the fact that the society's draft confines itself entirely to performance data.

"Further, in requiring three series of five tests on each boiler, one series for anthracite, one for bituminous, and one for coke, the proposed code imposes an almost impossible task upon the manufacturer because, as we interpret the code, it is not permissible to interpolate for test results, but rather each test must be reported separately. In other words, the proposed code requires the designers of steel heating boilers to abandon their present practice, a practice which is in universal use, and adopt a method of submitting to the prospective purchaser performance data and multi-ratings. We believe that no such radical change should be forced on any group in the face of its united opposition, and in the face of a thoroughly satisfactory method in current use for this class of boilers."

There is every reason why the cast-iron boiler people should favor the code, since in most respects, it is their own creation, the performance test requirements having been taken bodily from the code adopted by the National Boiler and Radiator Manufacturers Association, a little over a year ago.

In spite of the fact that strenuous efforts have been made by the steel boiler manufacturers to induce the A.S.H.V.E. code committee to make provision for dimensional ratings, the revised draft of the code has gone out to the membership without any such provision, and there is every likelihood that the A.S.H.V.E. code will be adopted in its present form. There remains, however, the question whether, in that event, the code will come into general use, and, further, what will happen if the steel heating boiler interests continue on their independent course with their dimensional, one-number rating. At the present time, there is some indication that they will do just that—hence the crisis.

LAST November HEATING AND VENTILATING announced editorially, upon what we considered ample authority, that the "code now put out by the steel boiler manufacturers has the tacit approval of the A.S.H.V.E. and is acceptable to the society on the ground that it supplements, rather than supplants, to any extent the A.S.H.V.E. code."

In the light of the present situation, it is clear that the support of the steel boiler interests might have been secured if the A.S.H.V.E. code had been confined to cast-iron boilers, and possibly this action might have paved the way for an even closer agreement later on.

AS announced recently, HEATING AND VENTILATING is compiling data for an "industrial" degree-day chart for the United States, based upon outdoor temperatures of 45° F. and 55° F. The chart will appear in our next (April) issue. It will be found particularly useful in determining the heating loads in industrial plants, factories, garages, and similar buildings. For such buildings, under the outdoor temperature conditions stated, the standard degree-day does not apply with sufficient accuracy. That is to say, the heating load in an industrial building maintained at a temperature, of, say, 50° F., is not 50/65 of the load calculated on the usual degree-day basis.

A Heating Plant with Boilers on the Roof

Ninth and Broadway Building,
Los Angeles, Calif.

by **ROBERT M. STORMS**

Mechanical Engineer, Office of Claud Beelman, Architect, Los Angeles, California

EVER since the first steamfitter ran the first pipe to the first radiator from the first steam boiler, it has been the custom to place the steam generating plant for low-pressure heating in the basement. This was the natural thing to do. Steam went up the pipe, water fell down back to the boiler—such was the old theory and practice.

Water still falls back down the pipe, even in this age of motor cars, airplanes and radios. Old Man Gravity is still on the job. But it has long been accepted as good practice in low-pressure heating to feed the steam down from a distributing main located at the top of the building and collect the water of condensation at the bottom of the building, conveying it by gravity back to the boiler located at the lowest point. A vacuum pump cleared all lines of condensation and air and also established a rapid circulation of steam throughout the system.

Rapidly expanding use of the motor car has resulted in acute traffic conditions in the "downtown" or business sections of our cities, so much so that most modern business structures are planned nowadays to be either very close to parking spaces or with such spaces included in the building itself. Basements accommodate themselves readily to the storage or parking of cars; usually there is sufficient headroom and a ramp of moderate grade can generally be installed from street level to basement floor without sacrificing too much floor space.

The first question asked is "Where shall I place the boilers?" Space is at a premium. Every additional car that is run into the basement means just so much additional revenue to the owners.

Seemingly, the only thing to do is to excavate a room under the basement at the most convenient point and place the boilers down there. But this costs money. The deeper the excavation, the more the cost per cubic yard.

Building foundations must be carried further down, retaining walls built and sometimes costly underpinning must be resorted to to keep friend neighbor's building from falling into our basement. Always a main steam riser must be installed, large enough to supply the entire building and a smoke stack must be run from the boilers up through the entire height of the building to a point above the roof.

In the spring of 1929, our office was commissioned to prepare the plans and specifications for a limit-height loft building at the northeast corner of Ninth Street and Broadway, Los Angeles, Calif. This meant a thirteen-story building. Among the requirements were basement and sub-basement garages, every possible square foot of which was to be devoted to storage and parking space for motor cars.

A careful estimate showed us that we would have to spend a large amount to go still further down for the boiler room, mainly on account of some expensive underpinning required for the building to the north.

The suggestion was made by Mr. Beelman that we put the boilers on the roof. This seemed rather fantastic at first thought, but why not? There was plenty of room up there

—in fact, the whole roof area could be used for the housing of the equipment necessary to operate the building. In Los Angeles, rentable office space is not permitted in roof pent houses, so valuable space was not being used for the boiler plant. The elevator machinery and the sprinkler system tanks were to be housed in a 35-ft. high pent house in which we could run the smoke stack, giving us sufficient height for the proper boiler draft. In both the basement and sub-basement were spaces unsuitable for cars, but large enough for the pumps we would need.

However, we did not know what the reactions of the city building department, the fire department or the board of fire underwriters would be to a roof boiler plant. We planned to equip the boilers with both oil and gas burners, so that either fuel could be used, one always being in reserve in case of failure of the one being fired.

Our first visit was to the building department, which could see no objection to such an installation, provided we would secure the approval of the fire department, which in Los Angeles exercises a strict supervision over all boiler installations, especially where oil is used for fuel.

Somewhat to our surprise, the fire department became very much sold on the idea, asking only that we comply with their usual requirements and certain other recommendations which they deemed necessary for the safety of the building and the people working in it. It was immaterial to the board of fire underwriters where we placed our boilers, for their regulations would apply in any case.

The Ninth and Broadway Building is a thirteen-story, basement and sub-basement loft building, having a frontage of 100 ft. on Broadway and 148 ft. 2 in. on an alley on West Ninth Street. It is equipped with an Underwriters' automatic sprinkler system throughout, with one 20,000-gal. gravity tank and two 7500-gal. pressure tanks located in and on top of a three-story, 35 ft. high pent house, which also houses the elevator machinery, the exhaust fans and the house tank. A separate one-story pent house contains the boiler room. It is about in the center of the building east and west and near the north building line. The floor of the boiler room is 1 ft. 10 in. below the main roof level and is reached either directly from the roof or from the main stairway of the building.

Oil Tanks Situated Under Sidewalk

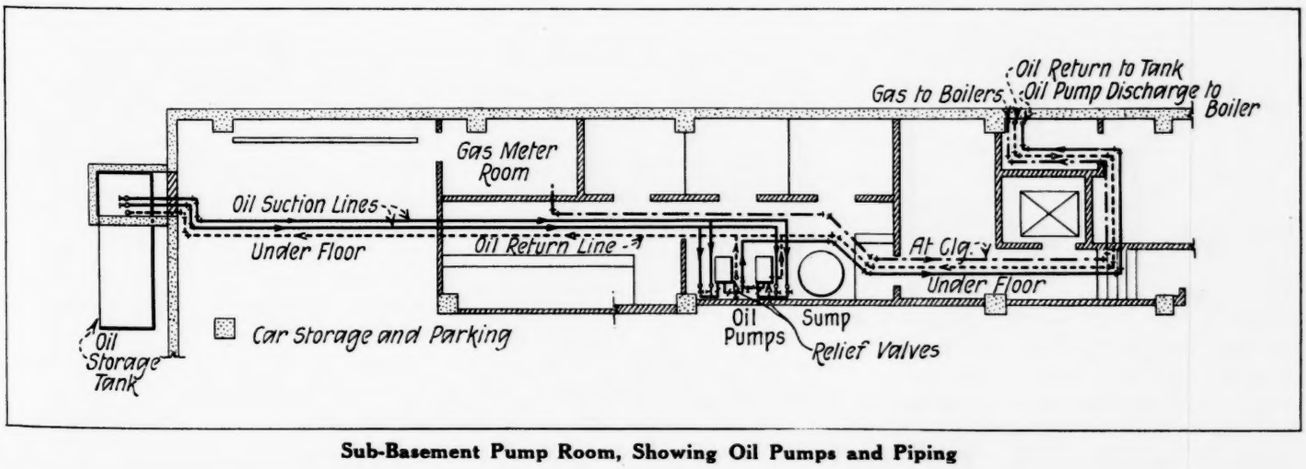
There are 228 radiators containing a total of 9208 sq. ft. of direct radiation in the building, figured on an outside temperature of 30° F. and an inside temperature of 70° F., this being the usual range figured in Los Angeles. An allowance of 2500 sq. ft. of equivalent direct radiation was made for heating the air supply to a restaurant on the first floor.

Two cast-iron oil-burning boilers were installed, each having a catalog rating of 7900 sq. ft. of equivalent direct radiation. Space was left for a third boiler of like size, should the building ever be converted into an office building, in which case the additional window and wall exposure would require more boiler capacity. For heating the hot water required in the building, an oil-burning cast-iron steam boiler, having a catalog rating of 3700 sq. ft. of equivalent direct radiation was installed near the main heating boilers and in the same room. Each boiler is equipped with the usual set of trimmings and is insulated in the usual manner with 85% magnesia blocks. In addition, certain other equipment was installed on the boilers, the water, gas and oil piping, all of which was made necessary by the type of system installed, described later.

Fuel oil is stored in a steel tank, 5 ft. in diameter by 14 ft. long, located under the Broadway sidewalk, near the north property line and as close as possible to the two oil pumps. The tank is provided with the usual manhole, filler, vent, return and gauge connections and also two independent oil suction lines, both of which can be used by either pump.

The two oil pumps are located in the sub-basement pump room, the floor of which is two feet higher than the top of the manhole of the storage tank. Each pump is of the spiral-gear direct-drive type, mounted on cast-iron bed plate direct connected to a 1½ H.P., 1450 R.P.M. A.C. motor. Each pump has a capacity of 7 gal. of oil per min. at 125 lbs. pressure.

Each pump discharges into a common 1½ in. oil pressure line, made up of extra-heavy galvanized-steel pipe, with extra-heavy screwed fittings and valves. This line is carried under the sub-basement floor and up to the boiler room in a concrete pipe-shaft, along with various other piping lines and the ventilating flue from basement and sub-basement.



Sub-Basement Pump Room, Showing Oil Pumps and Piping

At the top of the shaft and on a level with boiler-room floor, the oil pressure line is carried from the shaft into the boiler room in a small concrete trench, and extended across the floor to the combination burners of the boilers.

Each of the two oil-pump discharge lines in sub-basement, and the main oil line in boiler room are provided with brass relief valves, discharging into a common oil return-line run back to and connected with the oil-storage tank. These valves protect the lines and pumps from excess pressure and allow the engineer to secure the exact operating pressure necessary for firing the boilers. A pressure gauge is installed in the pump room, and in the boiler room another gauge, also a thermometer, are placed on the main oil pressure line to boilers.

Boilers Equipped to Burn Both Gas and Oil

Each of the two heating boilers is equipped with a low-pressure air type oil burner inserted through the boiler front just above the gas burners, and a similar burner supplies fuel oil to the smaller water heating boilers. These burners have cast-iron flared air tips and bronze flared oil tips, with brass burner bodies, and are manually operated by V-type oil control valves. The air connection is made through a 2-in. quick-acting air valve manually controlled.

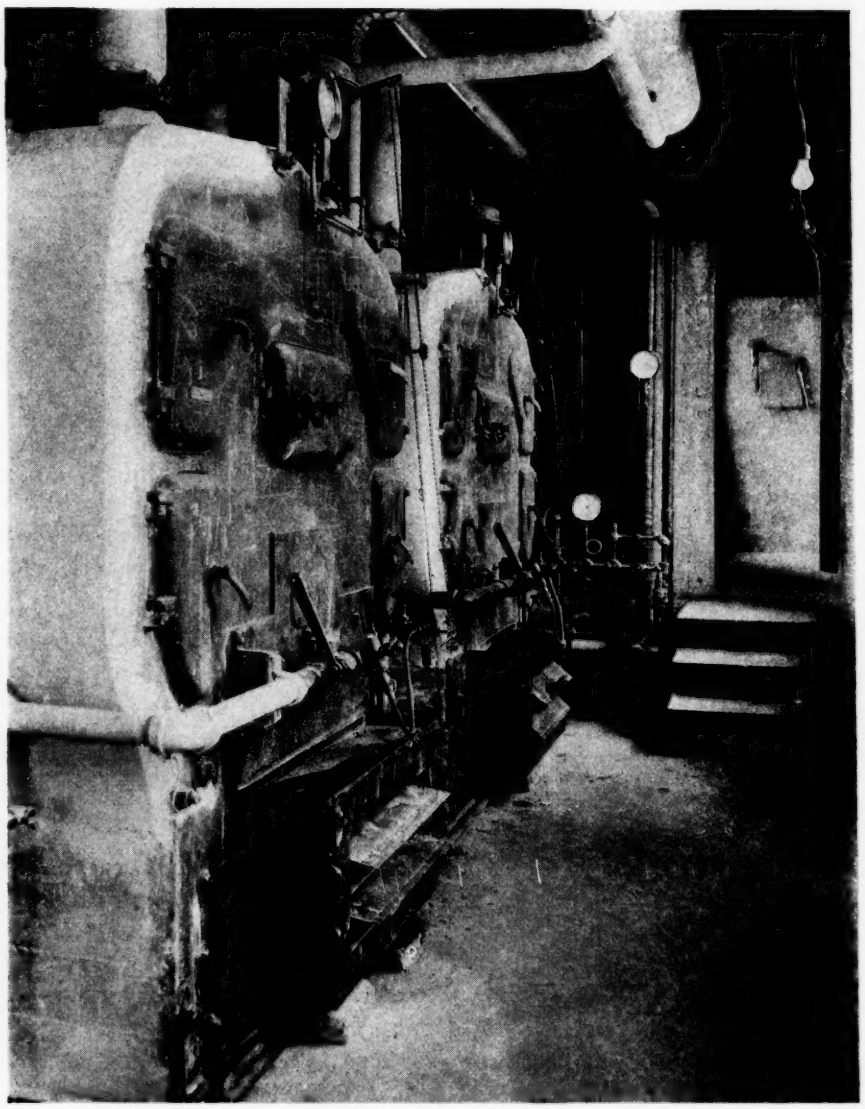
Each of the gas burners has five gas spuds, one of which is arranged to be used as a pilot light. Four burners are installed in each of the two heating boilers; two burners are in the small boiler. The gas burner manifolds holding the spuds are bolted in the proper position on the steel front plates of the boilers. Moulded combustion blocks of refractory material are set on the inside of the front plate and in the proper position relative to the burner spuds.

All air admitted to the combustion chambers passes through the combustion blocks and is properly mixed with gas before entering the fire box. This air is controlled by dampers located in the draft boxes which are securely bolted to the front plates and enclose the burner assembly. Tops of the damper boxes are removable for burner inspection. The shutters controlling the air are swung on ball bearings held in position by cast-iron bearing covers mounted on the outside of the draft boxes. On the two larger boilers the draft boxes are partitioned so that when only one set of burners is used, one damper can be disconnected from the regulator control chain. On the two large boilers each set of two gas burners is separately controlled by manually-operated gas cocks; on the small boiler each gas burner is separately controlled. Gas burners operate at 1-lb. pressure.

Each boiler is equipped with a combination pressure and low-water control, controlling the motor circuit of the oil pumps and a solenoid motor valve in the gas line to the boiler. A pressure regulator, operating direct from the boiler pressure, controls regulating valves on the gas and oil lines to each boiler, also the damper shutters on the draft boxes. A gas cock is installed on the main gas line to each boiler.

Each of the three boilers is mounted on a 24-in. high concrete foundation, with 10-in. thick concrete side walls. Furnace floors, which are also the concrete floor of the boiler room, are paved with a 2-in. layer of dry sand, then a layer of Featherstone brick, and a final layer of fire-brick laid flat, with the fire-brick extended up to the top of the concrete foundations with a fire-brick checker flash wall in the center.

The blow-off basin, or boiler drain tank, is 3 ft. 6 in. diameter by 3 ft. 6 in. high, built of ¼-in. thick welded steel, set in a concrete pit in boiler floor. On account of a steel floor beam, this tank had to be set so as to project 1 ft. above the floor. The boiler sump into which the blow-off basin discharges, required by the city ordinances, consists of ¼-in. thick steel welded tank, with open top and provided with a grating at floor level, set in a 24-in. deep and 24-in. square concrete pit. The in-



Boiler Room on Roof of Ninth and Broadway Building

side of the blow-off tank, also the inside and outside of the sump tank, are painted with one coat of Bitumastic solution, and one coat of Bitumastic enamel, applied hot. Both the blow-off basin and the sump project into the thirteenth story but are hidden from sight by a suspended ceiling.

Boiler outlets are extended full size into a 6-in. welded subheader for each boiler, parallel to the long dimension of the boiler. Each subheader connects full size into a main 10-in. welded distributing header across and above the front of boilers, with flanged gate valves in each 6-in. connection. A blanked outlet is left in the main header for a possible future boiler, and from header, connections are made to the steam coil in the hot water tank, to the indirect heaters on the first floor for restaurant ventilation and to the main distributing line to the radiators, located in the suspended ceiling of the thirteenth floor.

All of the down-feed risers connect to this line, each with a gate valve, and each riser is carried through to the basement, and trapped into the main vacuum return line leading to the vacuum pump.

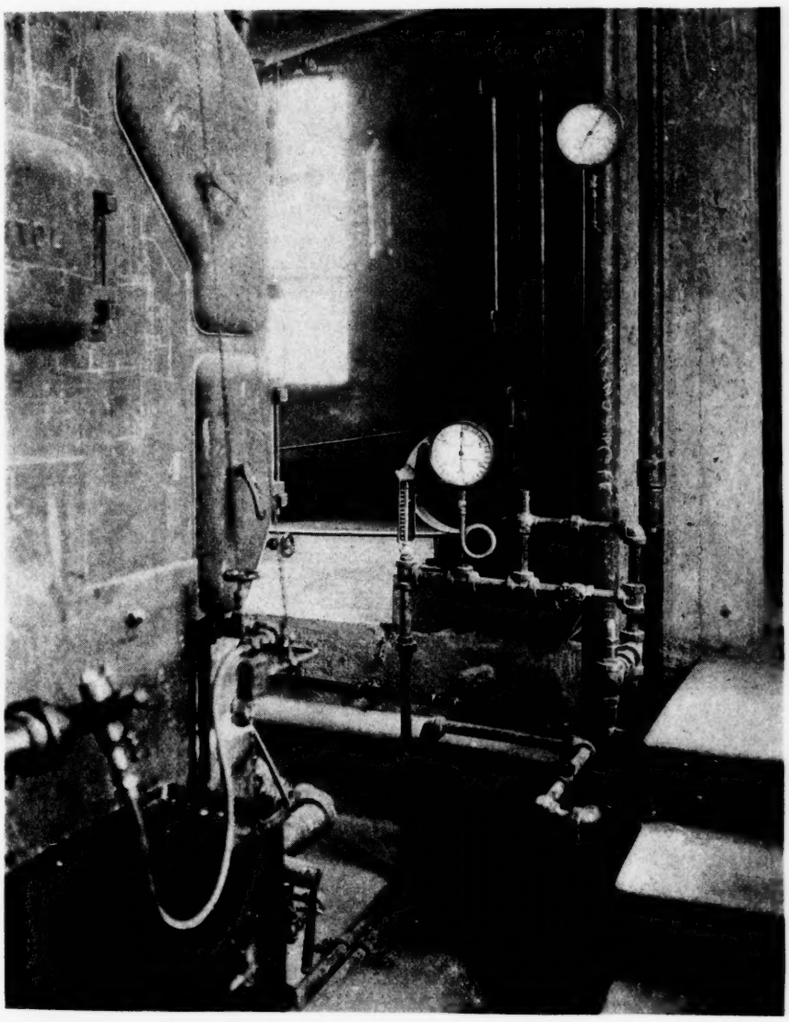
All return risers, drips from the bases of steam risers, the return from the coil in hot water tank and the return from the indirect heating surface are collected together into a main vacuum return line run to and connected with the vacuum return pump located in the basement pump room.

The vacuum pump discharges into a 16 in. diameter by 2 ft. 4 in. long receiving tank. A bypass enables the engineer to operate the plant by gravity without the use of the vacuum pump. The receiving tank is connected to a condensation return pump, packed to handle 180° water, having a capacity of 15 gal. of water per min. against 100 lbs. pressure. The pump motor is controlled by a float switch in tank and pump discharges directly into the boilers on the roof.

All steam piping throughout is insulated with standard 85% magnesia covering, but no covering has been applied to the return lines. All of the oil piping lines were tested at 150 lbs. pressure, steam and return lines at 30 lbs. pressure.

On January 1, 1930, the building was opened for occupancy and the boiler plant was operated on that date and continuously since with from 4 in. to 8 in. of vacuum on the boilers. The condensation pump returns all water promptly so that it has not been necessary to use any make-up water to the boilers after the initial filling. Natural gas from the high-pressure main of the Southern California Gas Company in West Ninth Street has been used as fuel and has proved to be very satisfactory.

Although equipped to burn fuel oil, it has so far not been possible to use the oil-burning equipment, due to the lack of electrical connections for the pumps and air blower. Although no especial precautions were taken to prevent noise, the sound of the gas burners is not audible on the thirteenth floor, directly under the boiler room, nor is there any evidence of overheating of the concrete floor slab of the boiler room.



Entrance of Oil, Gas and Condensation Return Lines from Basement into Roof Boiler Room

No Extra Structural Work Necessary

We believe we have worked out an idea that can be applied to many buildings in Los Angeles. It was found that the extra structural work required for the roof boiler plant was entirely absorbed in the framing necessary to carry the loads of the sprinkler system tanks, which of necessity must be located above the top floor.

We have saved for the owners the expense of a boiler room under the sub-basement, which, in this building, would have been a big item, and have secured the hearty approval of the fire department, which believes that the placing of the boilers on the roof entirely eliminates the danger of panic due to the heavy smoke from an oil fire and that in the event of fire, the damage from smoke and water would be confined exclusively

to the boiler room. And, as chemicals must be used to extinguish such a fire, it is believed that it would be just as easy to put it out on the roof as in the basement, maybe easier.

In cities allowing a greater height limit than the 150 ft. one of Los Angeles, also where oil or gas are not available for fuel, the roof boiler plant might not work out so well. The cost of hoisting coal and removing the ashes would in itself be sufficient to eliminate such a layout in any but very low buildings and, where basement space is not at a premium, it is the logical place for the boilers and probably always will be.

Installation Cost 5% More Than Usual Method

It is rather difficult to estimate exactly the difference in cost between a basement boiler plant and one on the roof. In the Ninth and Broadway Building, the contract for the heating work was between 4% and 5% greater than it would have been had we placed the boilers under the sub-basement floor. Offsetting this extra cost, however, is the saving due to lack of excavation, concrete work, underpinning, etc., required for the boiler room, rentable space saved had we used a portion of basement or sub-basement, and, of course, the elimination of a fire hazard which always exists in a boiler room under a building.

The architect is Claud Beelman; mechanical engineer, Robert M. Storms; heating contractor, Howe Brothers; chief engineer for heating contractors, Charles Weatherbee.

Equipment

Heating boilers—Two Capitol, Series 0400, cast-iron, oil-burning type, United States Radiator Corporation.
Hot water boiler—Capitol, Series 0230, cast-iron, oil-burning steam type, United States Radiator Corporation.
Oil line relief valves—Crane Company.
Oil burners—Two No. 7 Johnson low-pressure, and one No. 5 Johnson low-pressure, S. T. Johnson Company.
Gas burners—English and Lauer, Inc.
Pressure and low water controls—Time-O-Stat Duplex, Time-O-Stat Controls Company.
Pressure regulator—Hoffman Specialty Company.
Light-weight indirect heaters—Aerofin Corp.
Radiators—3-tube, 20-in. Capitol, United States Radiator Corporation.
Radiator valves, traps and drip traps—Warren Webster & Company.
Vacuum pump—Nash 16,000 sq. ft., size B, single, Nash Engineering Company.
Condensation pump—Deming "Oil Rite" 3 in. x 3½ in., 15 g.p.m. at 100 lb. pressure, Deming Company.
Steam and water piping—Spellerized steel, National Tube Company.
Return piping—Toncan iron, United Alloy Steel Corporation.
Oil piping—extra-heavy galvanized steel, National Tube Company.

The Industry's Major Needs

by **WILLIAM V. HOIER**

Secretary Chicago Master Steamfitters' Association

HERE are what I believe to be the five most important problems of our industry:

1. Ethics—the science that treats of the human morality and duties.
2. Standards—that which is established as a fixed rule, measure or criterion.
3. Capital—the sum invested in any business, stock in trade or resources.
4. Ability—the power to perform, the skill to achieve, the capacity to devise, talents or gifts in a special or general degree.
5. Traditions — the delivery of opinions, doctrines, and customs from ancestors to posterity.

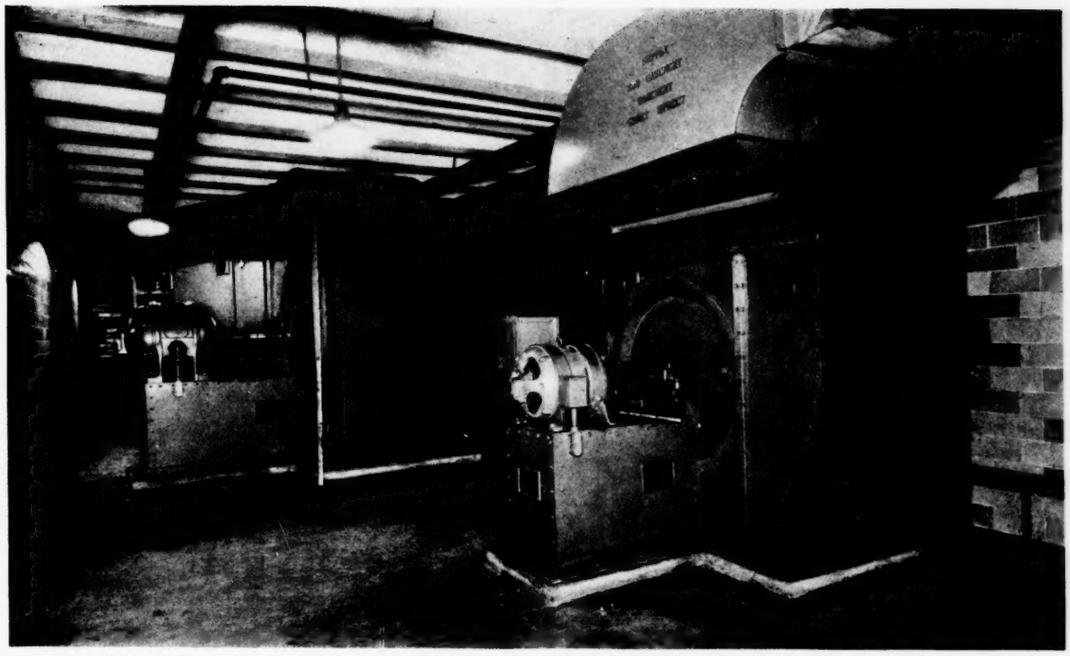
1. The lack of ethics in our business and profession has made itself felt through unfair competition. The extension of unearned privileges to clients not extended to others under like conditions and similar terms. The habit of rebating. The unfortunate practice of contractors to contribute the pools of fly-by-night promoters and architects who propose to build large speculative projects which often fail to materialize and leave the contractors who were gullible enough to contribute minus a considerable sum of money.

2. Standards — We have in our business no accepted standards or rules as to what constitutes the items which legitimately belong to our industry. We permit architects, owners, general contractors, engineers and others to purchase materials and equipment for which we are often only required to furnish the labor for installation, and, often, guarantees for the entire installation and equipment are expected from us without any compensation except that which is included under the items of labor. A definite schedule of labor and material should be formulated and accepted as a standard jurisdiction, claimed by us and covered by our field of operation.

3. Capital—Many new contractors enter into our industry without sufficient capital to qualify them to handle the class of work on which they expect to compete. They often trust to Providence that credit will be forthcoming from manufacturers, supply houses and sub-contractors. Strange to say, their faith in the past has been realized to such an extent that today in our city this class of contractors owes approximately two million dollars to the creditors which is now past due. Credit is a privilege and, for the mutual benefit of the parties involved, this benefit should be withdrawn immediately, if and when abused.

4. Ability—Many new men enter into the contracting business from the ranks of the journeymen, estimators, engineers, salesmen, or through accident. It will be well for them and the trade in general if a clearer conception of the duties, liabilities and trade requirements should be taught them before entering into competition with the established contractors in this field. Too often we find the source of competition from new firms so unequitable that it clearly demonstrates the lack of ability, foresight and reliability.

5. Traditions—Our industry is in its infancy and perhaps lacks the background which other professions, such as doctors, lawyers, scientists, etc., can justly lay claim to. For that reason a closer bond should be established between our various local, national and affiliated trade organizations so that a clearer conception of our duties to our clients, competitors, our families and ourselves may be arrived at, and conscientiously adhered to by all, so that our industry might take its place by the side of other professions which are receiving, and justly so, the respect and esteem of the American people.



Direct-Connected, Alternating-Current Squirrel-Cage Induction Motors Driving Fresh-Air Fans in Basement, Koppers Building, Pittsburgh

Selection of Motors for Centrifugal Fans

by **J. F. LAMB**

General Engineering Department, Westinghouse Electric & Mfg. Company

APPLICATION of centrifugal fans to a given ventilating system in a building involves the selection of electric motors to be used for driving the fans. Because of the effect of the fan characteristics upon the motor requirements, and because the type of control required and the space available must be considered, the selection of a motor driving the fan should receive considerable thought.

This discussion will be limited to the application of motors to multi-blade centrifugal fans, since this is the type most often used in the duct systems found in buildings.

In selecting a motor for driving a centrifugal type fan, the following points should be considered:

1. Horsepower requirements,
2. Power supply available,
3. Method of connection between fan and motor,
4. Operating speeds,
5. Method of air volume control,
6. Efficiency and power factor, and
7. First cost.

The fan itself is usually selected by:

a. First calculating the air delivery in cubic feet per minute required of the fan,

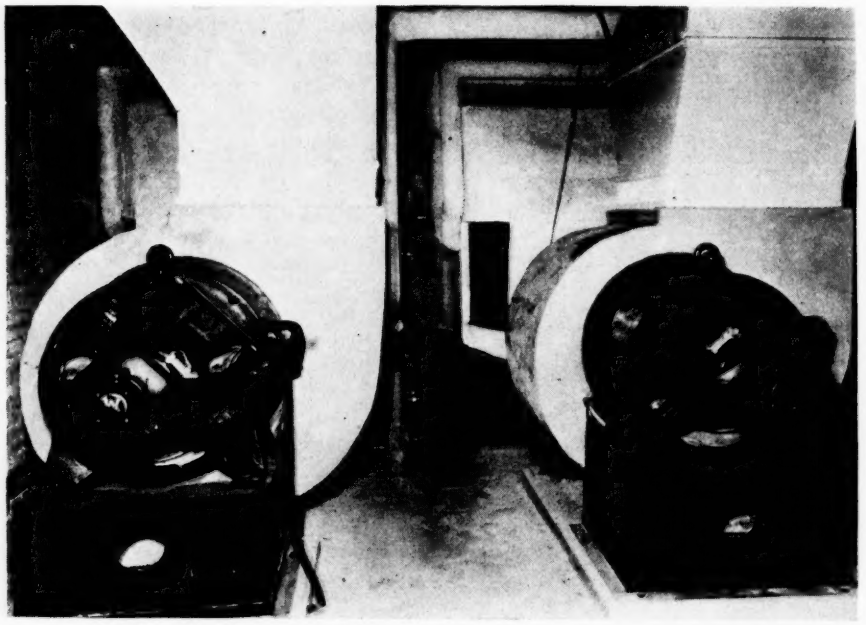
b. Calculating or estimating the static pressure in inches of water or the resistance to air flow of the duct system as designed for the required air delivery, and

c. Selecting a fan from the fan builder's catalog to fulfill these requirements.

Fan manufacturers' tables usually give the brake horsepower input required for the fan at different speeds, static pressures, and air deliveries, usually for air at some standard conditions such as 70° F. and 29.9 in. of mercury. These brake horsepower values usually are based on tests made in accordance with the standard test code for fans as adopted by the American Society of Heating and Ventilating Engineers and by the National Association of Fan Manufacturers.

In practice, the fan is always applied under conditions different from those holding during a standard test. The air delivered by the fan in actual use may have a different temperature and pressure than the air delivered in the standard test. Errors in calculation or estimation of the duct resistance are almost certain to occur.

The fan manufacturer's tables of brake horsepower can be used as a basis for selecting the horsepower size of the motor by considering the various characteristics of the usual design of the multi-blade centrifugal fan. For a given duct system and a



Direct-Connected Direct-Current Motors on Fans in the Dorset Hotel, New York

given fan the following relations hold.

Horsepower requirements vary directly as the cube of the speed. That is, doubling the speed multiplies the horsepower required about eight times.

Capacity in cubic feet per minute varies directly as the speed. Halving the speed will, therefore, halve the air delivery.

Horsepower varies directly as the density of air moved. A given volume of warm air requires less horsepower to move than the same volume of cold air at the same pressure because the density of the warm air is less.

The above relations indicate that the delivery of the fan can be controlled by varying the speed. Because of the rapid falling off in horsepower as the speed decreases, a motor that can carry the fan load at its rated speed can also carry the load with the same duct system at reduced speed in spite of the decreased motor ventilation at the lower speed.

Conversely, a motor can easily be overloaded if the fan is speeded up (by a change in pulley ratio or other means) in order to increase the air delivery.

Errors in calculation of the duct system resistance will affect the air delivery and brake horsepower input of the fan. This effect will depend in a large measure upon the design of the fan.

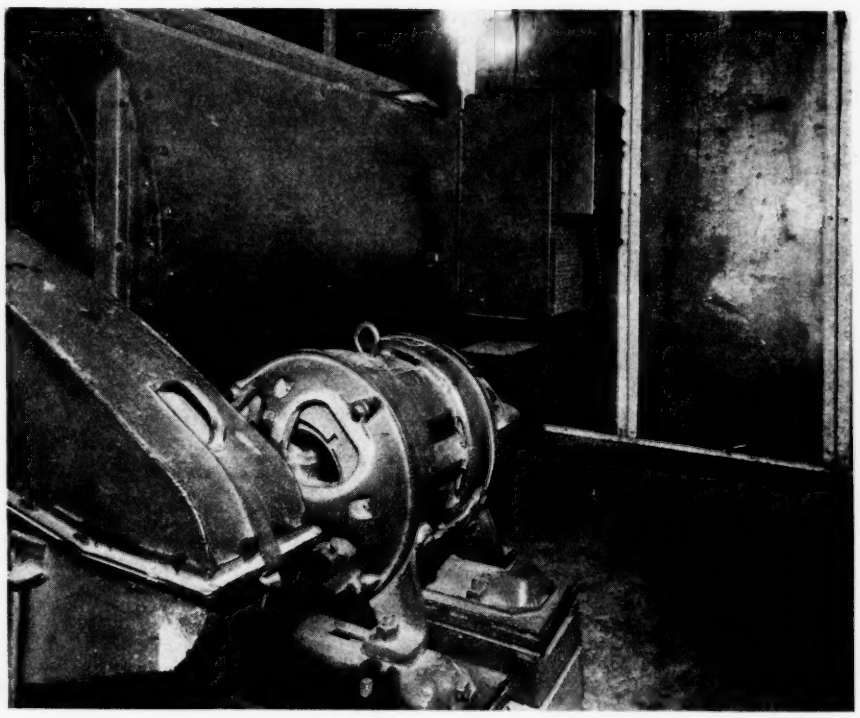
Multi-blade centrifugal fans may have forward curved blades, radial blades, partially backward curved blades, or fully backward curved blades.

Fans with fully backward curved blades or with blades of compound curves can be designed with operating characteristics such that changes in the duct resistance have comparatively small effect on the capacity and horsepower. Such fans can be made practically non-overloading at constant speed. A motor can easily be selected with horsepower capacity sufficient to handle all the fan requirements at the rated speed or lower speeds.

Fans with other types of blades have characteristics which may greatly increase the brake horsepower required and the air delivered as the duct resistance is decreased. Therefore, the brake horsepower will be greater than figured on if the duct resistance has a lower value than that calculated.

If the duct resistance is larger than that estimated, the air delivery will be less than that desired as a maximum requirement for the duct system. The air delivery, of course, can be increased to the desired maximum value by increasing the speed of the fan with a change in pulley ratio or other means. This again increases the brake horsepower over the original calculated requirements because, at the increased speed, the fan must deliver the required air capacity against a greater resistance than expected, so that the horsepower required is greater than that calculated.

Therefore, it is suggested that the rated power of the motor driving a centrifugal fan usually exceed the rated brake horsepower input of the fan by a liberal margin of from 10% to 25% of the rated value, depending upon the type of fan blade. Where errors in the calculation of the duct resistance are known to be rather large they should be allowed for, and the brake horsepower requirements



220-Volt, 60-Cycle, 15-H.P., 6-Pole, 3-Phase, Wound Rotor Induction Motor, with Silent Chain Drive to Fan Furnishing Warm Air for the Grant Building, Pittsburgh

estimated using the data supplied by the fan builder.

Power supply available for driving large centrifugal fans will either be alternating current or direct current. The most common voltages are three-phase, 60 cycles, 220 volts alternating current and 230 volts direct current.

The volume of air delivered by the fan is usually made adjustable in most duct ventilating systems to take care of differences in ventilation requirements for different periods as well as errors of calculation in the duct resistance. This can be done in one of two ways:

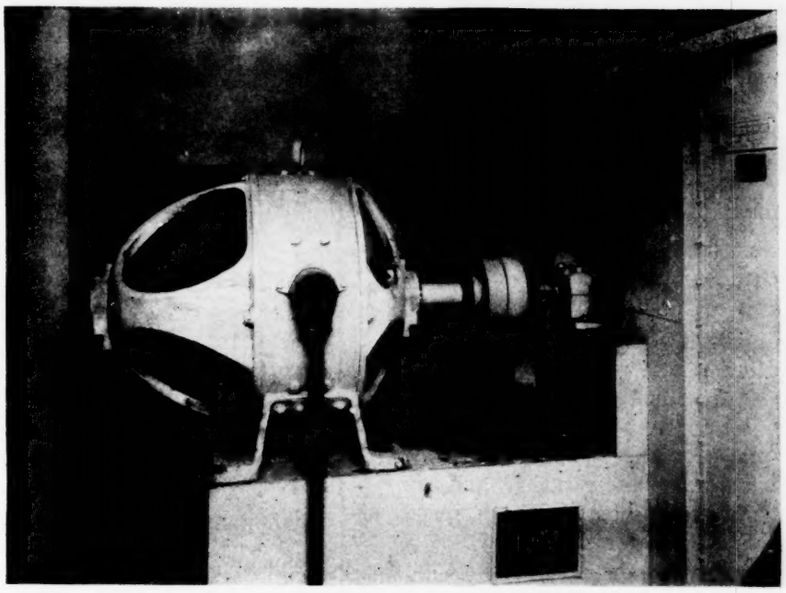
1. Using dampers to regulate the air flow, or
2. Using variable or adjustable speed motors.

Because it is more economical in energy consumption than damper regulation, the second method is usually more desirable.

The method of speed variation and type of drive depend largely upon whether alternating current or direct current power is available.

Cost and size of an electric motor decrease as its rated speed increases. The most suitable operating speeds for fans, particularly in the larger sizes, are usually considered slow speeds from the standpoint of the motor manufacturers.

If direct current is available, the motor is usually, although not always, directly coupled to the fan, eliminating belt losses and cutting down space requirements. Direct current motors can be designed to operate at almost any speed usual in fan practice. Slow speed direct current motors are efficient and quiet in operation. The speed of a direct current motor can be increased easily by inserting a resistance in the motor field, the efficiency remaining substantially the same. In purchasing a direct current motor to be used with a fan, the range of speed adjustment desired should be specified, and the motor should have a horsepower rating equal to the horsepower which will be required when driving the fan at the maximum operating speed.



Direct-Connected Direct-Current Motor Driving Fan in the Drake Hotel, New York

The speed of direct current motors can be reduced by inserting resistance in series with the motor armature. Because of the losses in the speed regulating resistance which considerably reduce the overall efficiency, this method of speed control for direct current motors rarely is used for centrifugal fan drives.

Large fans driven by alternating current motors are usually driven through belts, chain drives, cog belts, or similar drives. Alternating current motors are usually higher in speed than the fans they drive. The no load and synchronous speed of an alternating current motor depends entirely upon the frequency of the alternating current supply and the number of poles for which the motor is wound.

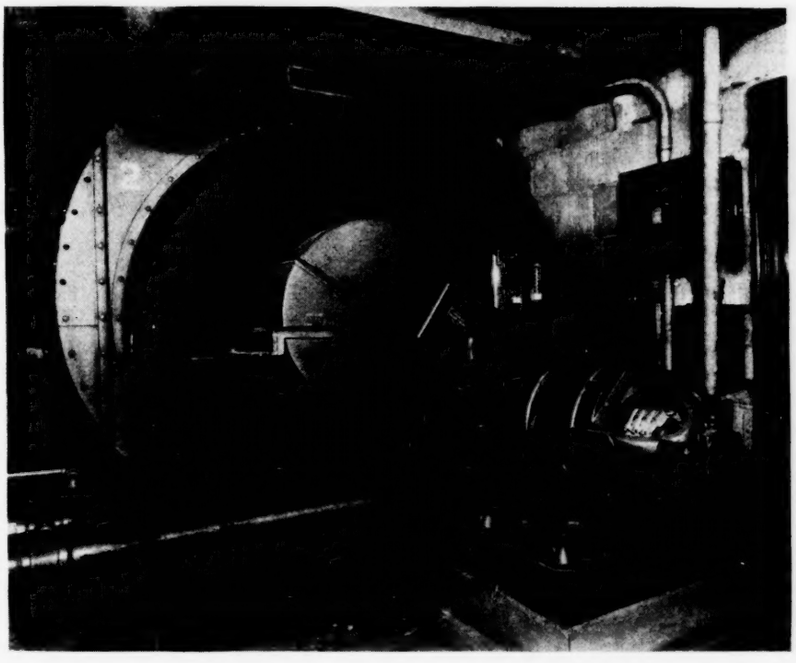
$$S = \frac{120\ F}{N}$$

where S = synchronous speed in R.P.M.

F = frequency of the alternating current supply in cycles per second.

N = number of poles for which the motor is wound.

For a given alternating current circuit, the larger the number of poles in the motor the slower the speed.



25-H.P., 1150 R.P.M., 6-Pole, 3-Phase, Wound Rotor Induction Motor Driving a Fan for Garage, Grant Building, Pittsburgh, Pa.

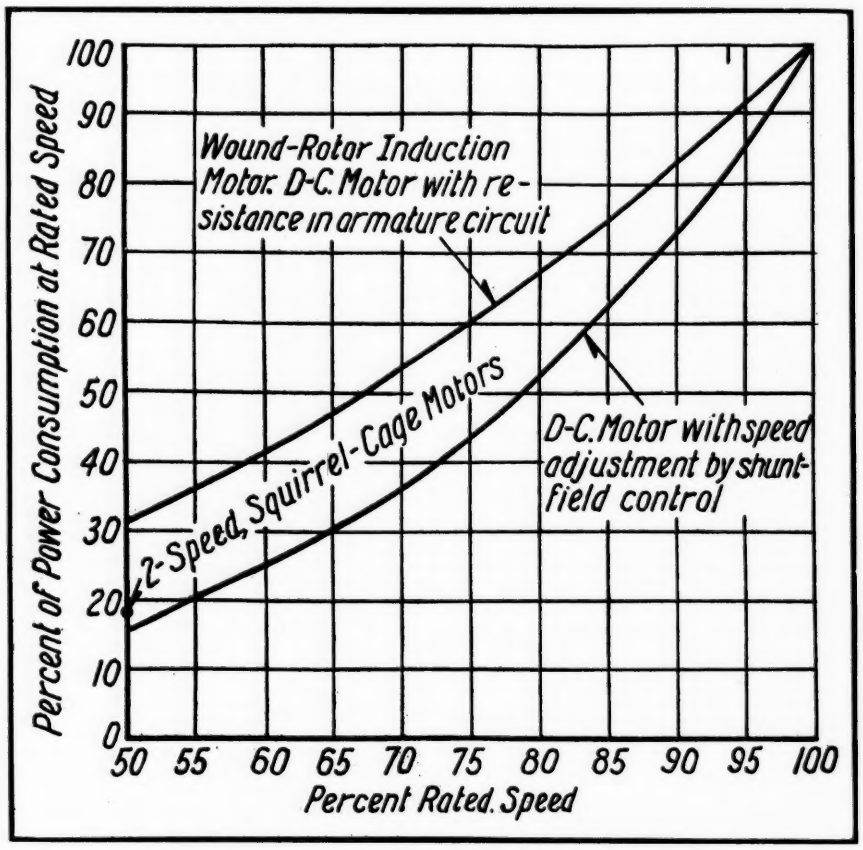
Synchronous motors are alternating current motors which operate only at synchronous speed and which have no slip. They are seldom used to drive fans in the ventilation of buildings because no speed variation can be obtained and because the horsepower sizes required for fan drives usually are too small for the synchronous motors to be economical in first cost.

Alternating current power supply is either single phase or polyphase. Single phase motors are more expensive, noisier and less efficient than two-phase or three-phase motors of the same horsepower rating, and are used only in the smaller high speed sizes, usually lower than 5 H.P.

The majority of alternating current motors used for driving large centrifugal fans are three-phase induction motors, on account of the low cost, ease of control, simplicity, and reliability of such motors. Where speed variation is not required, squirrel cage induction motors are used.

Where speed reduction is needed, wound rotor induction motors are used, and the speed is reduced by insertion of resistance in the secondary or rotor circuit. The speed can be reduced with satisfactory operation as far as the motor is concerned down to 50% of synchronous speed in this manner.

Efficiency of a wound rotor induction motor is considerably reduced by insertion of resistance in the secondary circuit, and is comparable with the efficiency of a direct current motor with resistance in the armature circuit under the same conditions. The reduced efficiency is due to the losses in the speed regulating rheostats.



Curves Showing the Relative Power Consumption of Adjustable Speed Motors when Driving Centrifugal Fans

Two to Four Speeds Possible with Special Squirrel Cage Motors

Squirrel cage induction motors can be supplied with special stator windings to give a number of speeds, usually two, but not exceeding four. This can be done in one of two ways:

a. By using a single stator winding and regrouping the winding connections outside of the frame to change the number of poles, or

b. By having more than one separate stator winding, each winding being for a different number of poles. The speed is then changed by connecting from one winding to the other.

Although multi-speed squirrel cage motors with these special windings operate more efficiently at the lower speeds than wound rotor motors, they are usually not as desirable to use as the wound rotor motor because of their higher first cost, and less flexible speed control, as it is impossible to obtain intermediate operating speeds. Other desirable operating characteristics of squirrel cage induction motors are also sacrificed in order to obtain the multi-speed windings.

Slow speed alternating current motors are less efficient and more expensive than high speed alternating current motors. A slow speed alternating current motor with a large number of poles has a low power factor, which means that for a given horsepower output, the current drawn from the line may be considerably more than for a high speed motor. This means that heavier and more expensive wiring must be installed and greater losses will occur in the power feeders. The power bills are often increased on account of low power factor penalties enforced by the power companies.

The question of noise is quite important. Induction motors are built up of a number of iron punchings or laminations with slots in both rotor and stator. Certain slot combinations of rotor and stator are more quiet in operation than others. For a given horsepower rating, there are fewer slots per hole, as a rule, in a slow speed motor with a large number of poles, than in a higher speed motor. This means that the number of possible slot combinations is smaller with a slow speed motor. The chances of obtaining a quiet slot combination in a slow speed motor is therefore much smaller than that of obtaining a quiet slot combination in a high speed motor. This is why slow speed alternating current motors are usually noisier than high speed alternating current induction motors.

In some cases, it may be desirable to use a motor generator set or rotary converter for converting alternating current to direct current for driving fans in a building. For the vast majority of buildings it is usually better to use the available power directly.

Control for electric motors can be either manual or magnetic.

Direct current motor manual starters usually consist of a faceplate type starting rheostat operated by a handle on the front. The field resistors for speed control can be incorporated either in with the starting rheostat or as a separately mounted field rheostat, the former being the preferable arrangement.

Direct current motor magnetic starters can be remotely controlled from a pushbutton. Speed adjusting field rheostats can be mounted either directly on the starting panel or separately.

Squirrel cage induction motors can be started at reduced voltage either manually or by a pushbutton-controlled magnetic starter. Either an auto transformer or a starting resistor can be used to obtain the reduced voltage.

Where the power company permits, squirrel cage induction motors, especially in sizes of 30 H.P. and below can best be started by throwing them directly across the line. This method of starting permits the use of an inexpensive reliable pushbutton-controlled starter consisting simply of a magnetic line switch with a thermal overload relay to furnish protection to the motor.

Wound rotor induction motor controllers usually consist of manually-operated faceplates or drums wired to starting and speed regulating resistors and interlocked electrically with a magnetic switch identical in design to a squirrel cage motor line-starter. The magnetic switch connects the motor to the power supply and furnishes overload and low voltage protection.

Remote-controlled magnetically-operated starting and speed regulating controllers of various types can be obtained for both direct current motors and wound rotor motors in a large number of variations. One type, which is often applicable to large buildings, consists of a starter with a number of operating speed points controlled by a set of pushbuttons. Indicating lamps are used to indicate the particular speed setting at which the motor is operating.

Summary

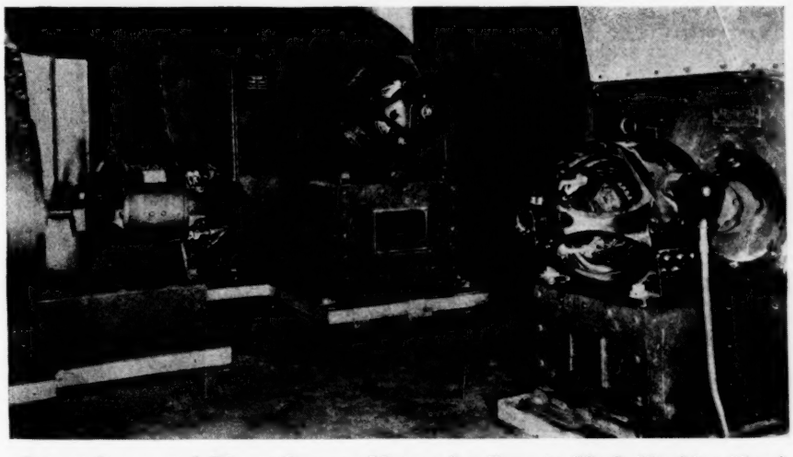
Although the fan manufacturers' tables of fan performance may be used as a basis for estimating the horsepower size of motor required for a fan drive, sufficient margin should be made for the effect of an error in the calculation of duct resistances and for a change in future operating conditions.

It is usually best to use the type of electric power which is directly available for driving the fans.

It is usually advisable to use direct current motors direct-connected to the fan because this arrangement provides efficiency in operation and flexibility of speed control, and requires a small amount of space. The volume of the fan output can be economically adjusted by varying the direct current motor speed with adjustment of its field rheostat.

Where polyphase alternating current power is available, fans can best be driven by high-speed induction motors through belts or similar drives. High speed induction motors are more efficient, quieter in operation, less expensive, and have a better power factor than slow speed induction motors, although, due to the belt drive, they may occupy more space.

Standard alternating current squirrel cage induction motors can be used where reduction in the fan speeds may be desirable to allow for different fan outputs at different times and for other reasons.



Direct-Connected Direct-Current Motors for Fans in Mark Hopkins Hotel, San Francisco

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Thermal Storage Electric Heating in Great Britain

DURING the past ten years there has been considerable development in electrical heating of buildings by radiators and other direct heating appliances in the United Kingdom.

Such appliances, however, require an unrestricted and continuously available supply of electricity; so that the prices charged for energy are governed by the same factors as apply to ordinary electrical supply for power purposes.

In the course of a most interesting lecture recently delivered before the Institution of Electrical Engineers in London, Lieut.-Col. S. E. Monkhouse and L. C. Grant outlined the methods which are available for utilizing off-peak electrical energy to heat water which can be stored in tanks lagged so far as to enable them to retain the heat for use when required during the remainder of the 24 hrs. The electrical energy can be converted into heat either by an equipment wherein the current is supplied to electrodes immersed in water through which the current passes or by resistance heaters, where the current is used to heat wire-wound resisters, which in turn convey their heat to the water.

An installation now in operation in Newcastle in a building of 500,000 cu. ft. capacity consists of a combined storage cylinder and boiler, the latter being of the electrode type and fed direct from a 6000-volt, three-phase supply, and absorbing 200-kw. at normal load. The cylinder has a water storage capacity of 6000 gal., giving a thermal storage capacity of 6,000,000 B.T.U.'s of useful heat.

Heat is supplied to the building continuously day and night, but current is consumed only between the hours of 7 P. M. and 7 A. M., the annual supply being 210,000 kw. hrs.

House-Heating by Gas

by **C. GEORGE SEGELER**

Industrial Editor, American Gas Association

Combustion, flue gas losses, gas pipe sizing and design and installation of gas boilers, all matters of importance to engineers, contractors and architects, are subjects covered in this second article by Mr. Segeler.

HEATING engineers, contractors and all others dealing with gas appliances, will want to know something of the special characteristics of gas fuel.

Table 1 gives the combustion characteristics of the simple gases that occur in varying proportions in all commercial gases sold. The heat of combustion will be found divided into a gross and a net value. The gross value is derived by adding to the net heating value the heat of condensation of water vapor formed on burning gas. Carbon monoxide, for example, which contains no hydrogen, has the same gross and net value, but methane, which contains 30% (by weight) of hydrogen chemically combined with carbon, will produce on burning a cubic foot, two theoretical* cubic feet of water vapor.

Gross heating value is used for all calculations, efficiency figures, etc., because it represents the total energy which can be derived if all the water is condensed out of the flue gases. Because of the nature of the condensate, all gas boilers and furnaces are designed to operate at flue temperatures high enough to prevent condensation of this moisture, and the flue losses which occur from gas appliances always include the heat losses due to uncondensed water vapor. Certain special forms of gas appliances are designed to operate condensers, and these have an extremely high efficiency, but special provision must be made to draw off the condensate and discharge it into a sewer.

Table 1 shows the combustion characteristics of typical commercial gases which are composed of mixtures of the simple gases as indicated in the appropriate columns. The column headed Ultimate CO_2 Per Cent shows the maximum percentage of CO_2 (carbon dioxide) which could be secured in the flue gases if combustion were absolutely perfect with no excess air.

Volume of flue products resulting from the combustion of 1 cu. ft. of gas =

$$\frac{\text{Cu. ft. of } CO_2 \text{ produced per cu. ft. of gas burned}}{\%\text{ of } CO_2 \text{ in flue products as analyzed}}$$

(Equation 1)

$$\text{Per cent of oxygen present in the flue products} = \frac{20.9 \times \%\text{ of } CO_2 \text{ in flue products as analyzed}}{\%\text{ ultimate } CO_2 \text{ for the gas}}$$

(Equation 2)

In the event that the term ultimate CO_2 is unfamiliar, a brief explanation may be of assistance. The maximum percentage of CO_2 will be found in the flue gases from perfect combustion. With coal practice 12% was adjudged very good practice but in dealing with gases the use of per cent CO_2 in the flue gases as a yardstick of operating results is unsatisfactory unless the ultimate percentage is known and borne in mind.

$$\text{Ultimate } CO_2\ \% = \frac{\text{Cu. ft. } CO_2 \text{ produced per cu. ft. gas burned}}{\text{Cu. ft. of total flue products (dry)}} \times 100$$

(Equation 3)

The ultimate percentage also can be calculated by using equation 4 based on the analysis of the flue gases.

$$\text{Ultimate } CO_2\ \% = \frac{\%\ CO_2 \text{ as analyzed}}{1 - \left(\frac{\%\text{ Oxygen as analyzed}}{20.9}\right)}$$

(Equation 4)

Equations 1 and 2 enable a check to be made on the flue gas analysis, or enable one to determine the ultimate CO_2 by analyzing the flue gases for CO_2 and oxygen. Nitrogen in each case is obtained by the difference, because the sum of the three must equal 100%.

Table 2 shows the flow of gas in pipes, based on a proper pressure loss through the piping between the meter and the gas appliances. Gas piping should be installed so that there are no traps in the line in which drip might collect and interfere with the service. It is usual to pitch gas piping away from the meter on the basis of 1 in. for each 50 ft. of run.

Equations 5 and 6 give the cubic feet of gas burned per hour for different rated outputs of steam boilers.

Cubic feet of manufactured gas per hour = 0.556 x sq. ft. of rated steam radiation. (Equation 5).

Cubic feet of natural gas per hour = 0.3 x sq. ft. of rated steam radiation. (Equation 6).

Fig. 2 shows the per cent of excess air present in flue gases as determined by the CO_2 analysis of the flue gases.

Fig. 1 shows the B.T.U. loss both as sensible heat, and as heat due to uncondensed water vapor in the flue gases of six typical gases. For example, if a conversion were made in

*Theoretical cubic feet of water vapor because the water vapor volume has been corrected to 60° F. and 30 in. pressure, but water vapor cannot exist under these conditions in actual practice, because at 60° most of the water would be condensed to a liquid, and its vapor pressure would only be 0.5 inches mercury. This volume of theoretical water vapor would reduce actually to 0.095 lbs. of liquid for each cubic foot of methane burned.

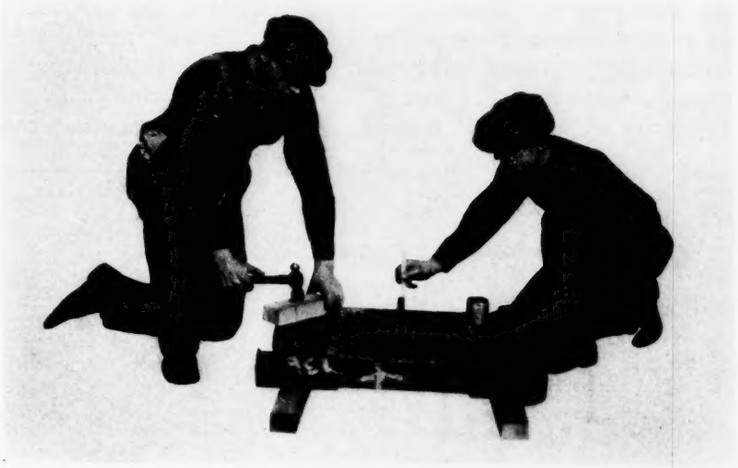
a town supplied with carburetted water gas, and showed 10% CO_2 in the flue gases, then there would be 72% of excess air present, and if the temperature of the flue gases were 270°, there would be 70 B.T.U. lost per cubic foot of gas burned, and out of an original heat value of 536 B.T.U., this would indicate 13% flue gas loss.

Ordinarily the heating contractor will not be interested in details about flue gases, but in dealing with conversion systems, the flue gas loss becomes very important. The data which have been given in the preceding section will be of value in checking the condition of the flue gases.

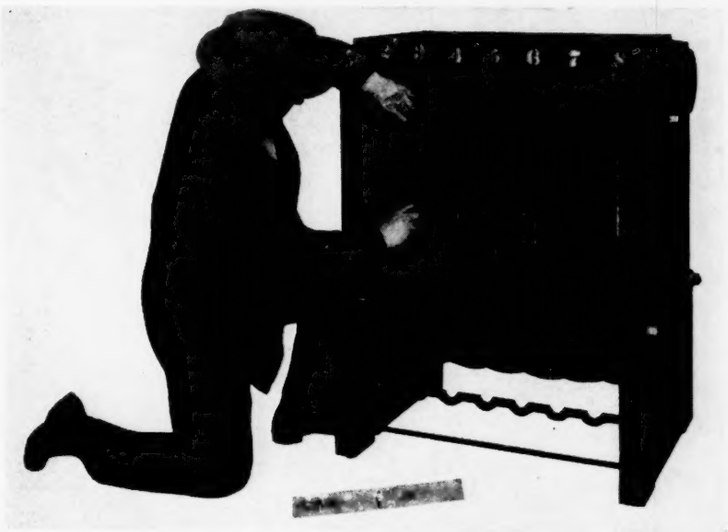
Flue temperatures from gas appliances are quite low, being under 300° for steam boilers, under 250° for hot water boilers, and frequently around 200° for warm-air furnaces. While steam condenses at 212°, the water vapor in flue gases is under such low partial pressures (there being other gases present than water vapor) that the condensation does not take place until the temperature drops to 130° and below.

Design of Gas Boilers

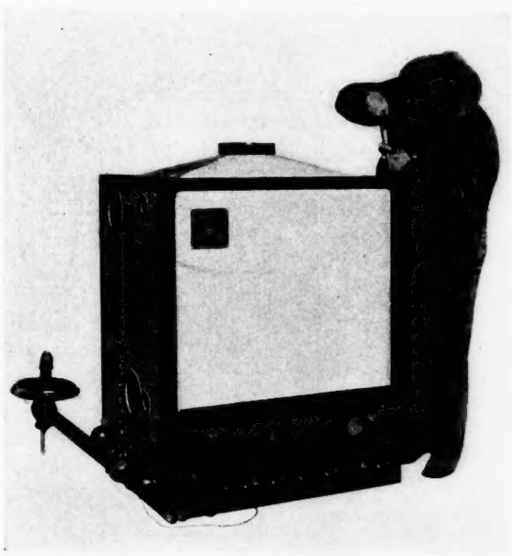
Although the general appearance of gas boilers is too well known to require description, it may be of value to discuss briefly the reasons for gas boiler design. Every gas boiler is of the vertical section type and in most of them there is an independent gas burner located be-



The Edges of the Vertical Sections Are Ground True, and Need only a Minimum of Red Lead to Make a Tight Fit with the Other Sections when the Boiler Is Pulled Up Tight. Care Must Be Taken that the Nipples Are in Place Correctly. No Lead or Compound Is Used on the Nipples



After the Boiler Is Erected and in Place, Suitable Cover Plates Equipped with a Gasket Close up the Clean-Out Openings, and Make the Entire Flue Passage a Gas-Tight System



Putting on the Finishing Touches. The Boiler Jacket is in Place, and Only the Trim Needs to Be Added

This 8-Section Boiler Has a Capacity of 1180 Sq. Ft. of Steam Radiation. The Three Tie Rods which Are Used to Pull the Sections Together Can Be Clearly Seen. Care Must Be Exercised That after the Sections Are Tight, the Nuts Are Backed off enough to Permit Expansion. The Safety Pilot and Burner Manifold Are Just about to be Put in Place

neath each section. These burners must be very carefully proportioned in order that complete combustion can take place without requiring a large excess of secondary air. In fact it is the very complexity of gas-burner design, that is, the relation of the burner to flue areas and heating surfaces which makes the construction of high grade conversions of coal boilers to gas firing so difficult.

Gas boiler sections are sometimes built to produce circulation similar to horizontal return tubular boilers,

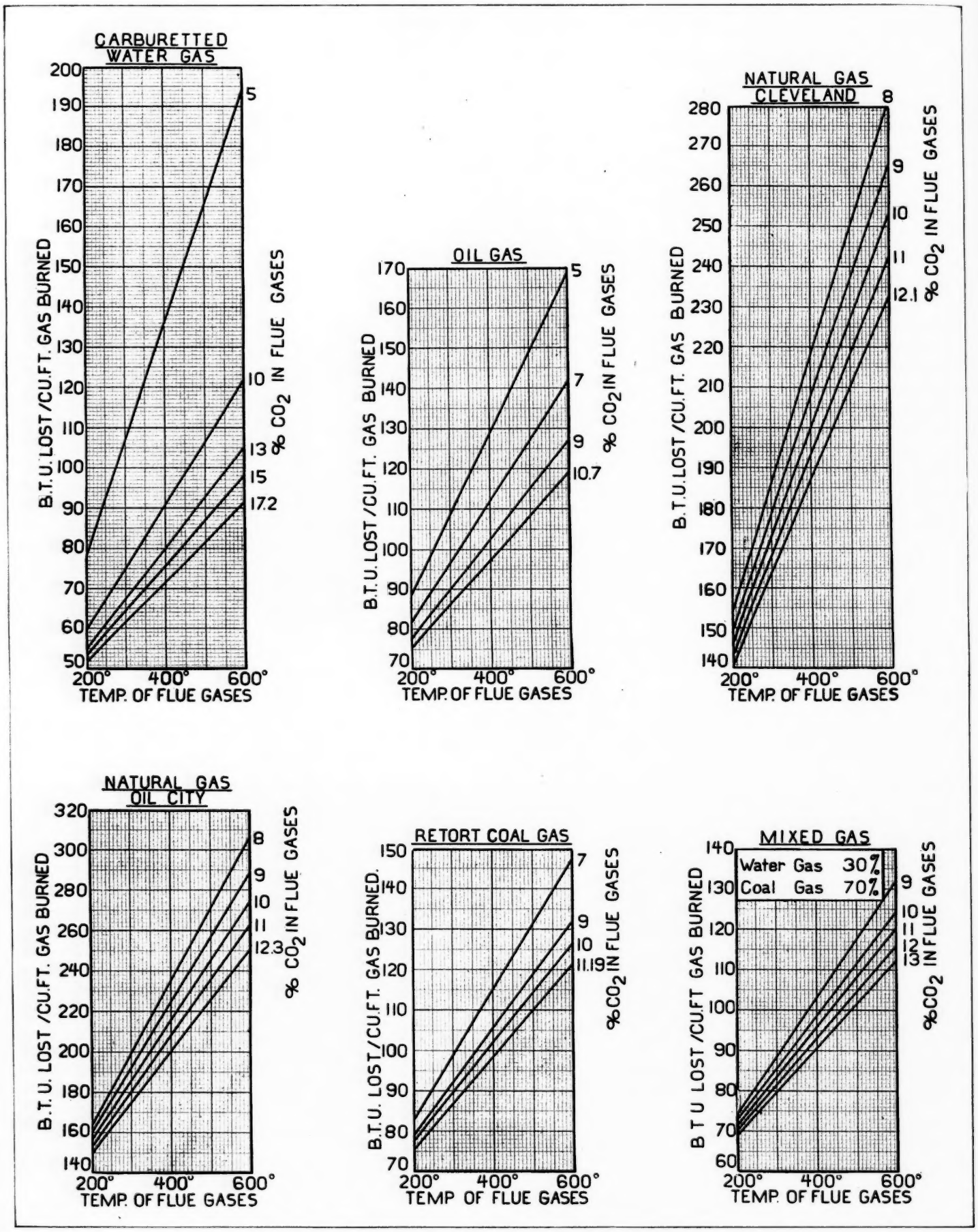


Fig. 1. Flue Gas Losses for Six Typical Gases

TABLE 1

Gas	Constituents of Gas—Per Cent by Volume									Specific Gravity Air = 1.000	Cu. Ft. of Air Required for Combustion of 1 Cu. Ft. of Gas	B. T. U. per Cu. Ft. Gross	B. T. U. per Cu. Ft. Net	Products of Combustion per Cu. Ft. of Gas				Ultimate CO_2 Per Cent.	Net B. T. U. per Cu. Ft. of the Products of Combustion
	CO	CO_2	H_2	N_2	O_2	CH_4	C_2H_6	Illuminants C_2H_4	Illuminants C_3H_6					CO_2	H_2O	N_2	Total (Dry)		
Natural Gas, Cleveland	.....	.....	.....	1.30	.....	80.50	18.20	.....	.....	.65	10.70	1131	1025	1.17	2.16	8.50	9.67	12.1	81.1
Retort Coal Gas (Horizontal)	8.6	1.5	52.5	3.5	0.3	31.4	.....	1.1	1.1	.42	5.00	575	510	.50	1.21	3.99	4.49	11.2	83.5
Coke Oven Gas Koppers Ovens	6.8	2.2	47.3	6.0	0.3	33.9	.....	2.6	.9	.44	5.23	591	525	.54	1.23	4.19	4.73	11.4	82.3
Carburetted Water Gas	33.4	3.9	34.6	7.9	0.9	10.4	.....	6.7	2.2	.65	4.37	536	496	.74	.75	3.54	4.28	17.2	88.5

while others have internal baffles to break up the flow. All gas boiler sections are set close together making narrow flue gas passages which are desirable from a heat transfer viewpoint as well as considerations of space required. Draft losses are very low through gas boilers because there is no fuel bed resistance. They always operate with a broken chimney draft—broken by the back draft diverter so that there will be a minimum draft particularly during the "off" period of the burners.

All gas boilers are equipped with pressure control governors designed to smooth out variations in the gas pressure which may occur from time to time. They should be adjusted on the job to the minimum gas service pressure likely to be encountered, following which the burners are to be adjusted to deliver full rating under the setting of the pressure governor. Adjustment is usually quite simple, as it is only necessary to remove a cover cap and turn the adjusting nut below. The factory setting is presumably for 3½ in. (water pressure) for manufactured gas and 7 in. for natural gas, but the local gas company can advise the proper value to use.

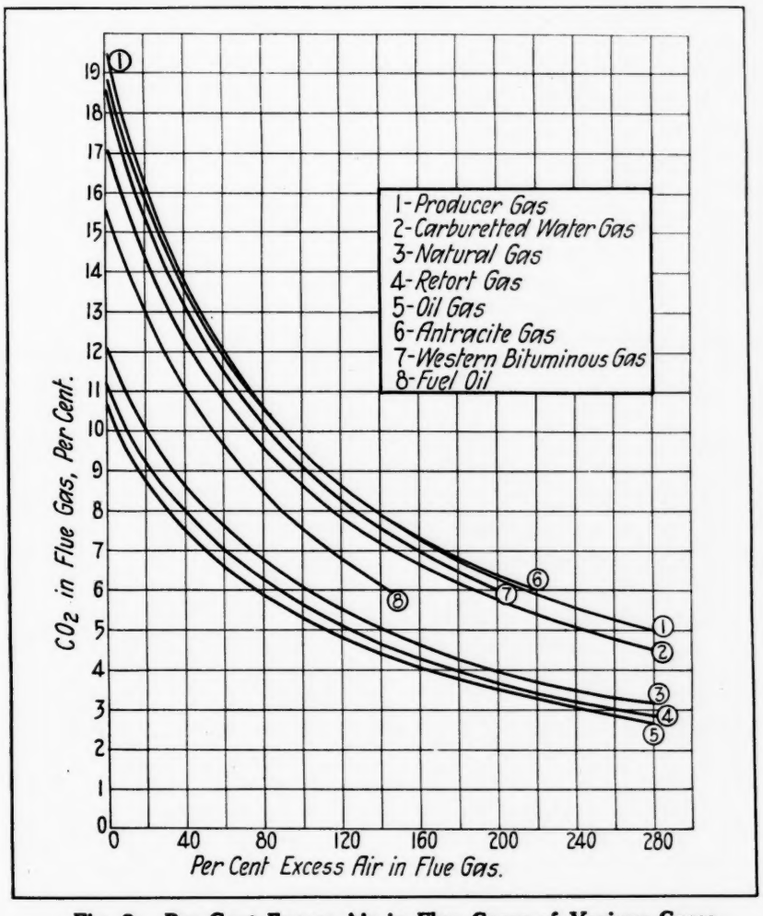


Fig. 2. Per Cent Excess Air in Flue Gases of Various Gases Based on CO_2 Content

The low water cut-off is a feature of gas boiler construction which protects the boiler in case of low water. Its operation is completely to shut off gas to the main burners if the water line on a steam boiler reaches a dangerously low point. Another safety device on all gas boilers is the safety pilot. This unit is connected to the main gas valve so that if the pilot should be extinguished, gas supply to the burners is shut off until the pilot is relighted.

Other fittings of a gas boiler are quite similar to those used for other forms of boilers, and need no special description here. They include, as a rule, a motor operated valve controlled by the room temperature thermostat, a water temperature control for hot water boilers, or a steam pressure regulator for steam pressure control. Gas boilers are furnished with snap action or throttling valve, depending on the type of installation. Throttling valves reduce the chances for burner flash back, since the burners do not go out entirely as frequently as they would under snap action control. The

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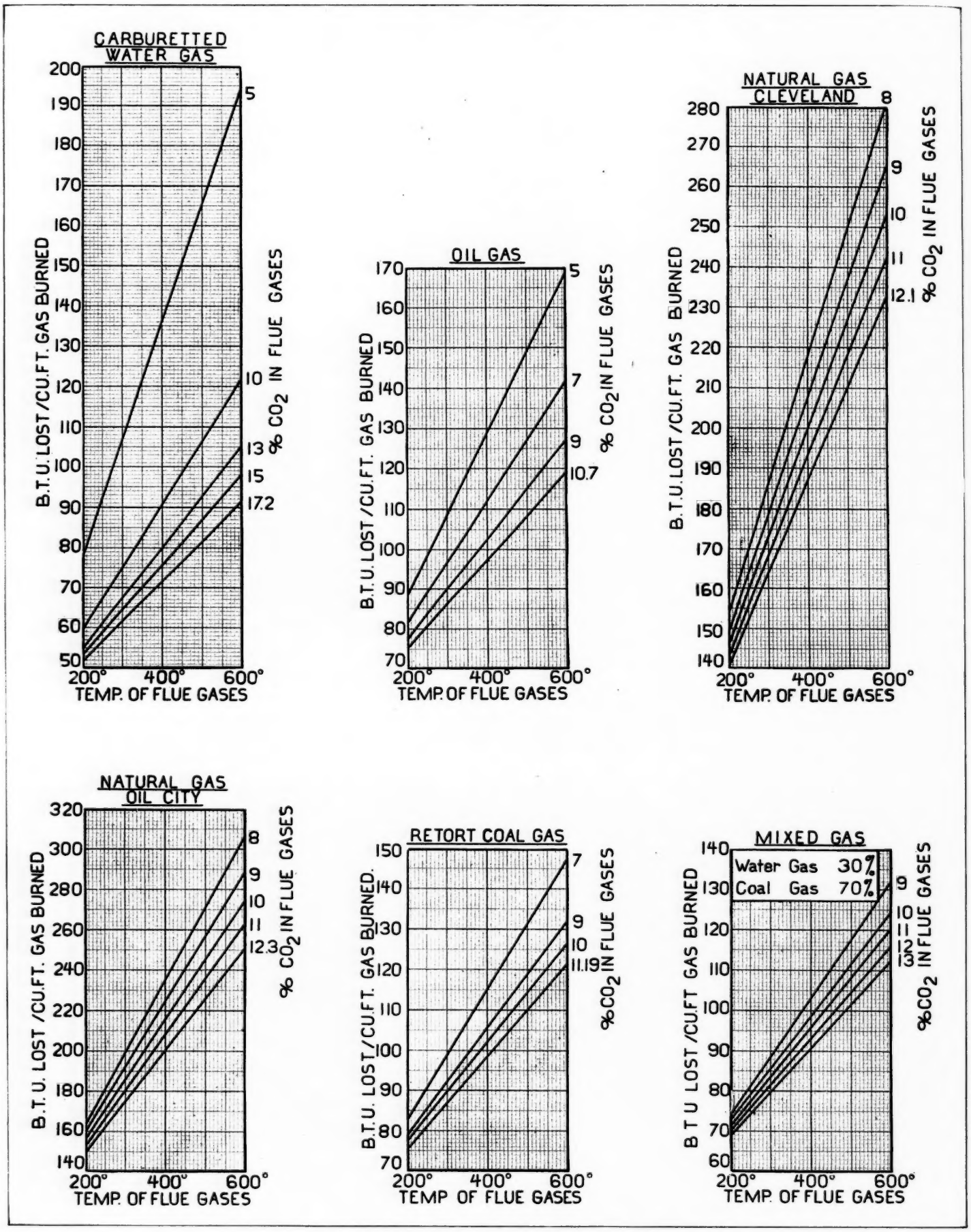

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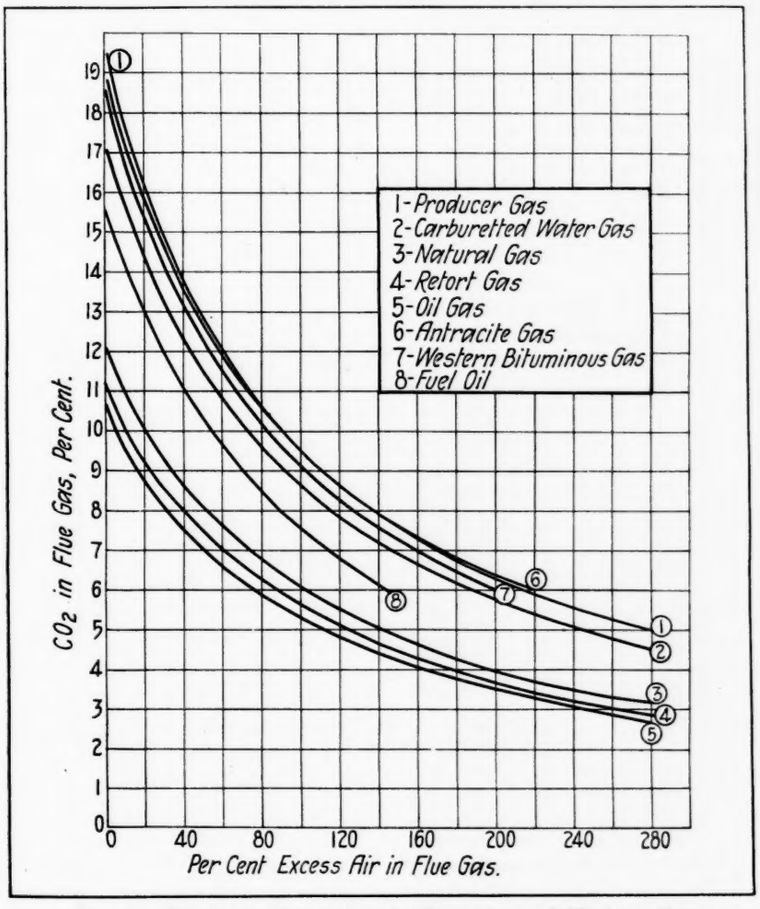

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TABLE 2

Capacity of Pipe of Different Diameters and Lengths in Cu. Ft. per Hour with Pressure Drop of 0.2 In. and Specific Gravity of 0.6

Length of Pipe, Ft.	Diameter of Pipe, In.					
	¾	1	1¼	1½	2	3
15	168	350	620	960	2,000	5,400
30	120	245	430	680	1,400	3,800
45	98	200	355	530	1,150	3,200
60	84	175	310	480	1,000	2,700
75	76	155	275	430	890	2,450
90	70	145	250	395	810	2,260
105	64	132	232	370	750	2,100

throttling valve is slightly more efficient under partial load operation but, when operating at full rating, there is no appreciable difference between snap and throttling valve controls.

Installation of Gas Boilers

Location of the Boiler.

Gas-fired boilers can be directly applied to any form of heating system. They will give satisfactory service when properly proportioned to the size of the installation but, on account of the higher fuel cost of gas, it is important that certain items be given careful attention in order to prevent any possible waste of fuel.

The first question is the location of the boiler. As a rule the location of the chimney will be the determining factor, because it is of advantage to have a short run of flue pipe.

Next, the more nearly central the location, the better the heat distribution, particularly where a one-pipe steam or hot water system is under consideration. Naturally, the shortest and most direct riser will tend to pass more hot water because of the lower frictional resistance.

All other things equal, the nearness to feed water may be considered.

Sometimes the headroom is so small that it is not possible to secure sufficient pipe pitch to prevent flooding of the steam main. This may require the construction of a boiler pit, or may call for the use of larger steam main so that there will be less frictional loss in piping.

The value of insulation is even greater with gas than with other fuels. All of the boiler piping and fittings should be properly covered.

Since gas boilers are built in vertical sections, very long boilers are likely to be put together, making it advisable to use a looped boiler connection, as shown in Fig. 3. This is a typical boiler piping layout, showing looped steam header, equalizer between the steam header and the return, flanges in the header risers, the relatively long, full size screw nipples both in header and for return connections to make service work easy, the horizontal check valve in feed water line which is demanded by some state codes, and safety valve in steam header but not in a back outlet L. Some boilers are constructed with loops running from front to back of the boiler. This saves considerable piping in larger installations.

There must be a minimum of pressure loss from the gas meter to the boiler. Usually architects' specifications read as follows:

"Gas Supply Line. Furnish and install . . . * inch gas connection with minimum number of bends or elbows from meter to boiler. If other gas appliances are connected to meter, furnish and install valve or controlling gas cock ahead of all controls and regulators of the boiler."

Some boilers are designed to vent the governors into the combustion chamber or into the flue pipe, but it is not uncommon to find specifications calling for the installation of a ¼ in. vent piping with union at the governor from relief opening in top or side of the gas pressure governor to a point outside of the building 3 ft. above the ground with an elbow on end faced down.

Burner Adjustment.

After a boiler is installed and water supplied so that the steam boiler is filled to the water line, and the hot water boiler filled until the expansion tank overflows, then the burner may be lighted and adjusted.

Proper combustion is indicated when the flame is sharp and firm, with a well-defined inner blue cone and no trace of yellow. The air shutter may then be moved so that the flame softens slightly. This will prevent any tendency to flash back.

If burners have flashed back and have operated in that condition for any length of time, it will be necessary to carefully clean them.

A common cause of flash back is the location of a pilot too close to the burner ports.

*The size of the gas supply line varies with the length of the runs and with the number of fittings. It should always be at least as large as the governor size, usually a pipe size or two larger.

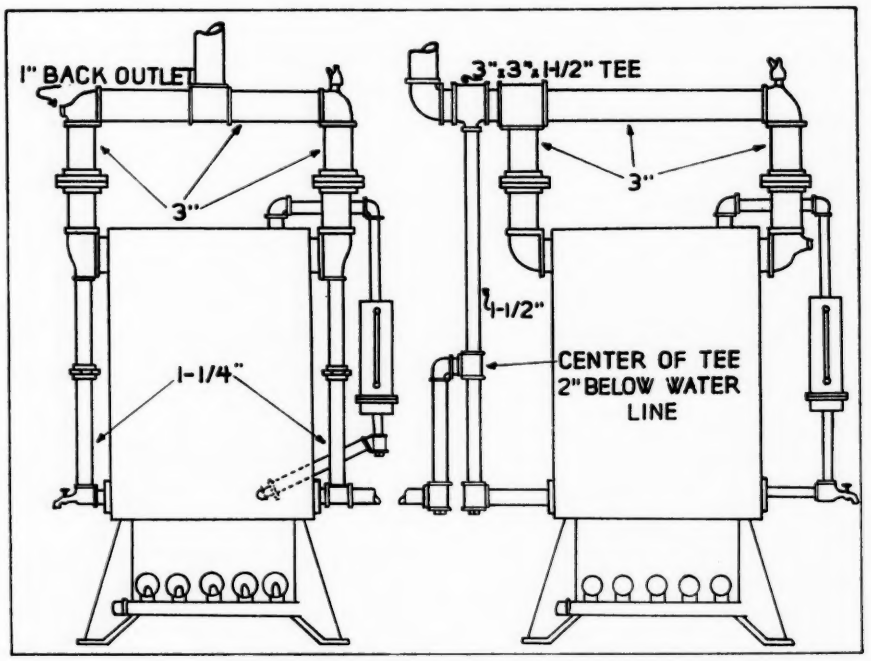
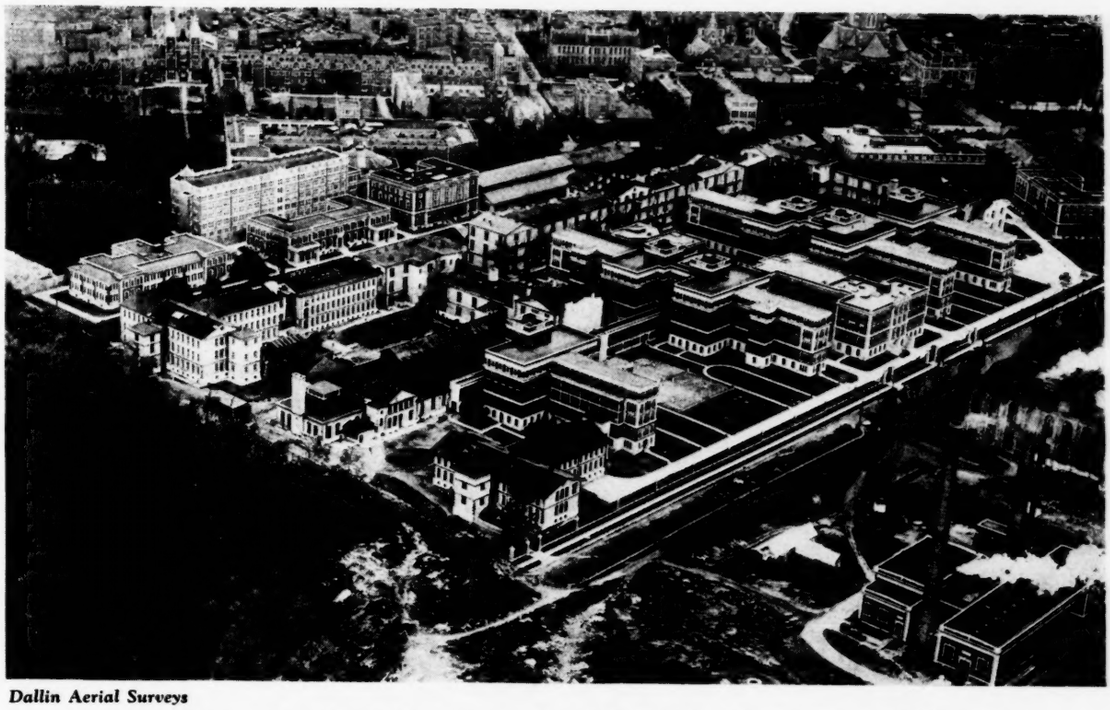


Fig. 3. Looped Connection of Gas Steam Boilers with Hartford Return Connection Shown at the Right



Dallin Aerial Surveys

Aerial View of the Philadelphia General Hospital, Showing the Six Ward Buildings, the Clinic Building, the Connecting Corridors, the Administration Building and the Annex to the Nurses' Home

Cost Data on Heating and Ventilating Equipment in Institutions

***by* G. KENDRICK BRINGHURST**

Mechanical Engineer, Office of Philip H. Johnson, Architect, Philadelphia

ACTUAL cost data on the heating and mechanical installations for certain municipal buildings, erected in Philadelphia and vicinity during a period covering the past four years, are presented in the following data. The work in these buildings was publicly advertised for bids and awarded to the lowest responsible bidder.

The new buildings, which are of fireproof construction, average five floors and a basement in height and are arranged on both sides of a connecting corridor 930 ft. long and two stories high. A central power plant with eight 400 H.P. boilers and four turbo-generators totaling 1200 K.W., for supplying heat, light and power to the 31 buildings comprising the institution was built in 1917, and the new buildings are served by connections from this station.

Mechanical equipment for each of the new buildings tabulated includes a high pressure steam connection from the tunnel piping under the connecting corridor to reducing valves in the new buildings, and the

TABLE I—COST OF MECHANICAL EQUIPMENT IN NEW BUILDINGS FOR PHILADELPHIA GENERAL HOSPITAL

	Approximate Contents Cu. Ft.	Cost of Mechanical Work in Per cent of Total Cost	Cost of Mechanical Work per Cubic Foot of Contents	Estimated Peak Load Lbs. Steam per Hour
(a) 6 Ward Buildings, a Clinic, and Connecting Corridors	4,055,000	12.4	11.0c	41,000
(b) Administration Building	834,000	9.5	6.9c	4,500
(c) Annex to Nurses' Home	657,000	7.0	4.9c	2,900
(d) Psychopathic Building (in 2 Contracts)	1,375,000	9.4	6.4c	12,500
(e) Ward Building "B"	635,500	7.1	4.7c	5,600
Totals	7,556,500	10.8	8.7c	66,500

TABLE II—BUILDINGS HAVING THEIR OWN HEATING PLANTS

	Approximate Cubic Contents	Cost of Mechanical Work in Per cent of Total Cost	Cost of Mechanical Work per Cubic Foot of Contents	Estimated Peak Load Sq. Ft. Equivalent D.R.
(f) Office Building (in 2 Contracts)	5,993,500 cu. ft.	7.9	4.8c	70,000
(g) City Morgue	335,200 cu. ft.	7.4	4.8c	4,600
(h) Hospital Dormitory	158,000 cu. ft.	6.4	3.8c	2,660
(i) Recreation Building	460,000 cu. ft.	5.8	2.2c	6,510
(j) Drill Shed	492,000 cu. ft.	8.5	1.4c	4,900
(k) Armory Building	250,000 cu. ft.	6.6	2.3c	3,200
(l) Public Library	175,000 cu. ft.	7.6	4.4c	4,000
(m) Public Library	175,000 cu. ft.	8.1	5.2c	4,000

condensate return piping, all supply and return connections for hospital and kitchen equipment requiring steam, a two-pipe steam heating system of piping with condensate receiver and pumps, cast-iron radiation with thermostatic return traps (with some concealed copper heat units in the Psychopathic Building), a complete system of automatic temperature regulation, one or more pipe coil storage hot water heaters, 85% magnesia insulation for all steam supply and return piping, and ventilation for all interior rooms.

Both the auditorium in the Administration Building, seating 500 persons, and the clinic amphitheatre are heated by blown air supplied at the ceiling and exhausted through floor mushrooms and grilles, with provisions for reversing the flow for summer ventilation.

Cost of the piping mains in the 930-ft. tunnel under the connecting corridor, together with 300 ft. across through the clinic basement to the old buildings, including two 8 in. high-pressure mains, one 4 in. high-pressure return and one 10-in. condensate return main, together with radiation and piping for heating the corridors, is included in Item (a) of Table I. Cost of trench piping from the corridor to the psychopathic building, a distance of 210 ft., and consisting of one 6-in. high pressure main, one 4-in. high pressure auxiliary and one 4-in. return main, is included in Item (d). The 6 in. high-pressure steam piping from the northeast end of the corridor tunnel to the nurses' home group of buildings, a distance of approximately 400 ft., is included under Item (c). The steam consumption for Items (a) and (d) is high, due to the large number of sterilizers, blanket warmers, urns, etc., which are constantly in use, and because of the great demand for hot water, particularly for the continuous baths used for psychopathic patients.

In percentage of the total cost, the four branches of work for the new hospital buildings averaged as follows: Building construction 75.2%, heating and ventilation 10.8%, plumbing 8.1%, and electrical work 5.9%.

Heating Constitutes Greatest Demand for Steam

Each of the above listed buildings has its own low-pressure boiler plant. The principal steam demand is for heating, with a proportionately small amount required for generating hot water. The heating systems in the office building and in the city morgue operate with vacuum pumps, and have a complete installation of automatic temperature regulation, while in the other buildings vapor systems of heating have been installed.

In all of the buildings cast-iron radiation is installed, thermostatic return traps being placed at the outlets from all steam radiation, and the steam supply and return piping is insulated with 85% magnesia, canvas covered. Additional mechanical equipment installed in each building is as follows:

(f) Office Building (fifteen stories high with basement and sub-basement, fire-proof construction) — Three 300 H.P. water tube, cross drum boilers and their accessories, mechanical atomizing burners, preheaters, blowers and pumps for 12° —16° fuel oil, and an 18,000 gal. capacity oil storage tank and connecting piping. Ventilation and heating of the main rooms and corridors of the ground floor and basements is provided for by means of large, slow speed fans supplying tempered air. Two 200 G.P.M. triplex house pumps, a pressure tank, pipe coil storage hot water heaters, and sewage ejectors were installed under the mechanical work, but the water and drainage piping connections to these units were done by the plumbing contractor. Mechanical work also included a vacuum cleaning outfit with piping connections to outlets provided on alternate floors of the building.

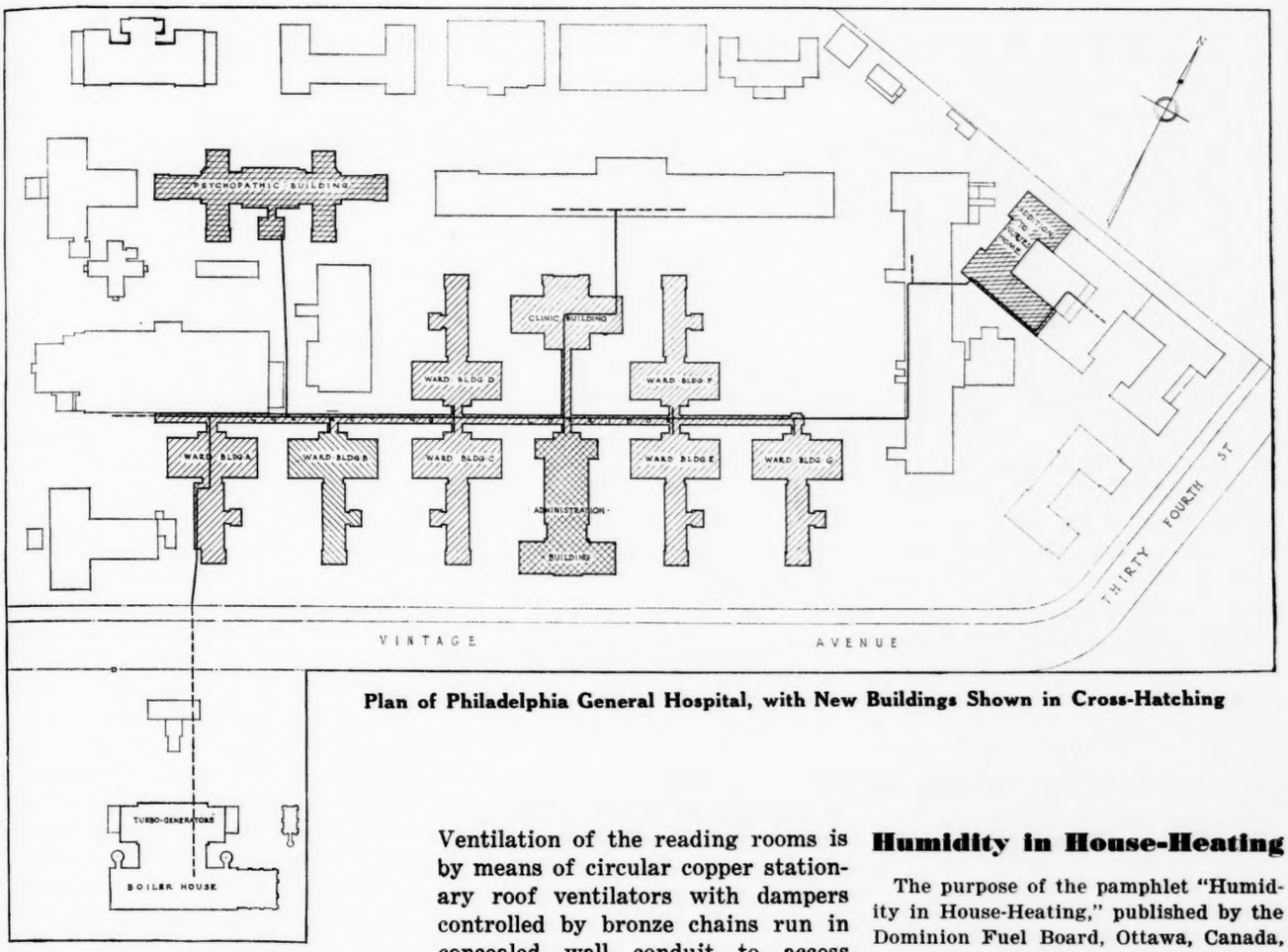
(g) City Morgue (three floors and basement, with one-story garage adjoining, fireproof construction) — Two direct draft welded steel tubular boilers, rotary type semi-automatic oil burners for 19°—23° fuel oil, a 3000-gal. capacity oil storage tank and connecting piping, an indirect coil water heater attached to boilers above and below the water line, a hot water storage tank, and wall type slow speed disc ventilating fans in all working rooms with exhaust ducts run direct to stationary roof ventilators. Blown air is used for heating the clinic and autopsy rooms in the main building, and overhead type slow speed unit heaters with mercoid controls for heating the adjacent gagage. Refrigerating machinery and cold room equipment were included under the building contract.

(h) Hospital Dormitory (two floors and a basement boiler room)—Two cast-iron sectional boilers for heating and one for hot water, burning No. 1 buckwheat coal with natural draft, an indirect coil water heater connected below the water line, and a hot water storage tank.

(i) Recreation Building (three floors and basement, fireproof construction). This installation is similar to that of Item (h), in addition to which ventilation of the Auditorium is provided for by means of a large, slow speed fan.

(j) Drill Shed (one story high and basement, drill shed 25 ft. high on first floor, storage rooms and garage in basement) — One cast-iron sectional boiler for burning No. 1 buckwheat coal with natural draft, slow speed unit heaters located overhead, with controls, for heating the drill shed, and ceiling type cast-iron radiation for heating the basement, indirect coil water heater, hot water storage tank, and a coal burning heater for summer hot water.

(k) Armory (front section is two stories high, with a drill shed in the rear considerably smaller than the



Plan of Philadelphia General Hospital, with New Buildings Shown in Cross-Hatching

one listed above)—This installation is similar to that of Item (j), except that there are two cast-iron sectional boilers, one for heating the drill shed and the other for heating the administrative section, each boiler provided with an automatically controlled furnace blower.

(l) Library (one story high and basement, with two large reading rooms 22 ft. high on first floor, administrative and classrooms in the basement). One cast-iron sectional boiler, rotary type oil burner for 19° —23° fuel oil, a 2000 gal. capacity oil storage tank and connecting piping, indirect coil water heater, hot water storage tank, and a coal burning heater for summer hot water. Ventilation of the reading rooms is by means of circular copper stationary roof ventilators with dampers controlled by bronze chains run in concealed wall conduit to access boxes.

(m) Library—This installation is similar to the above, except that the heating boiler is of the steel tubular type, the radiation under the book stacks is of the copper tube and fin type instead of cast iron, the sheet metal heat flues and insulation in the rear of the stacks were included under the mechanical work, a gas hot water heater is installed for summer use instead of a coal heater, and the stationary roof ventilators are of aluminum and are rectangular in shape. Bids for this library were received 22 months after those for Item (l).

In percentage of the total cost, the four branches of work for these buildings averaged as follows:

TABLE III—DISTRIBUTION OF TOTAL COSTS, PER CENT

	Building Construction	Heating and Mechanical Work	Plumbing	Electrical Work
Office Building	83.0	7.9	2.2	6.9
City Morgue	87.6	7.4	2.4	2.6
Hospital Dormitory	80.5	6.4	8.3	4.8
Recreation Building	84.8	5.8	4.0	5.4
Drill Shed	84.3	8.5	4.3	2.9
Armory Building	87.1	6.6	2.7	3.6
Library	82.5	7.6	2.6	7.3
Library	80.5	8.1	3.3	8.1

Humidity in House-Heating

The purpose of the pamphlet "Humidity in House-Heating," published by the Dominion Fuel Board, Ottawa, Canada, is to direct public attention to the fact that, with few exceptions, the air in homes during much of the artificial heating season is excessively dry.

In outlining the essential facts bearing on humidity in house-heating and in indicating practical methods together with types of apparatus for the obviation of undesirable indoor dry air conditions during the winter, the main object in view is not only to further the cause of good health, but to promote the more efficient employment of the fuel used in the heating of Canadian homes, offices and factories.

While the book is written for the layman, it contains much of interest for engineers, particularly those who are attempting to sell the idea of the importance of humidity to home-owners, architects, and the like. The first section is devoted to a discussion of air moisture, the desirability of humidity in houses and the prevention of air dryness in houses. The second section is devoted to the types of humidification equipment in connection with furnaces, radiator heat or radiant heaters, while the appendix contains instructions how to ascertain relative humidity.

Size 5½ in. x 7½ in. Pp. 38. Published by the Dominion Fuel Board, Ottawa, Canada, or the Natural Resources Intelligence Service, Department of the Interior, Ottawa, Canada.

Vacuum Pumps—Notes on Their Selection and Operation

by **F. H. WILLIAM**

THERE is often so much advantage gained and so much error overcome by the use of a vacuum pump in heating systems, particularly in larger installations, that it has led to their ever increasing use. It is strange that the engineer, using them so frequently and coming into contact with them almost daily, seems to show an indifference as to the principles on and the conditions under which they operate. Seeking information on the subject, one is brought abruptly to the bare wall of fact that the only general knowledge we do have is that they seem to function satisfactorily when installed according to the ratings given by the manufacturer.

Reviewing the bulletins and various catalogs, we find a rather general rule that the water capacity be equal to about two and one-half times the condensation rate, and that the air capacity be about four times the water volume capacity. This is modified somewhat by most manufacturers and the water capacity is taken as two times the condensation when the condensation is taken as one-third of a pound per square foot of radiation.

Thus for an installation with 12,000 sq. ft. of standard radiation the water capacity of the pump should be

$$2 \times \frac{12000}{3 \times 60 \times 8.3} = 16 \text{ gal. per min.}$$

and the air volume will be

$$4 \times \frac{16}{7.5} = 8.5 \text{ cu. ft. per min.}$$

This rule is presented as obtained from various manufacturers who, however, did not advance any mathematical basis of reasoning for its adoption, excepting that it was found from practical trial that the pumps functioned satisfactorily when sized upon this basis.

The ratio of air to water volume will vary due to the assembling of stock sizes of air and water impellers into one unit. Ratings are published in the various bulletins and the best policy for the engineer is to accept them for his design.

However, it is often necessary to choose between two sizes, as it will rarely occur that the pump will exactly suit his installation. Thus the ratings for the stock sizes of pumps may be given for 8000 and 16,000 sq. ft. of radiation, respectively, while his system may contain 12,000 sq. ft. The larger pump can, of course, maintain a vacuum under more adverse conditions, but often conditions may be found so favorable that the smaller size can be used with safety.

Principal causes tending towards destroying the vacuum in the return main are:

(a) the flashing of vapor from the condensate, where its temperature and quantity are the factors.

(b) Radiator trap leakage, and

(c) air infiltration through leaking connections.

The order in which these are given does not signify their order of importance, as the order will vary in different installations.

Use of Vacuum Pump Does Not Make a Vacuum System

With the varying character of the above factors the sizing of the pumps must be based on some empirical rule that will be adaptable to all general installations. The engineer, knowing his particular installation, the length of runs, the type of traps, the temperature and amount of condensation and the type of workmanship he may expect in the fittings, should use his judgment as to how far he may deviate from the rule.

It would be interesting if data were available on the variation in vacuum that prevails at different points in the average installation. But these data are so meagre, if any do exist, that they prompt a mental speculative stroll along the vacuum return lines.

In the first place, and in the strict sense of the word, a system equipped with a vacuum pump is not necessarily a vacuum system. Our earlier conception of a vacuum system was to have the pressure of the steam throughout the system, or at least in the radiators, below that of the atmosphere and hence have a temperature below 212° F., so that it would be adaptable for mild weather conditions as well as for the more rigorous periods.

Generally this was attained by having the total resistance in the circuit sufficiently large to preclude the delivery of the required amount of steam by the boiler pressure alone, and to produce the difference in the pressure drop, or the differential, by means of the vacuum pump. In numerical terms if, for a full supply of steam in any system, the total friction were 6 lbs. then the differential must be 6 lbs., and when the boiler pressure is 2 lbs. the pump vacuum must be 4 lbs., or 8 in. of mercury.

If the boiler were allowed to cool and its pressure were to fall below atmospheric, say 2 lbs. of vacuum, then the pump would have to carry 8 lbs., or 16 in. of vacuum, for approximately the same weight of steam.

These figures are cited to convey the idea of the differential and are not precisely true owing to the fact that to convey the same amount of heat in the lighter steam we would need a slightly higher differential. Too, in systems of this nature, the lower steam temperature would be carried during the milder periods when the full amount of steam would not be required and would possibly furnish sufficient heat with the pump carrying the original 4 lbs. of vacuum.

Some manufacturers of special appliances do design along these

lines with very good results but modern practice seems to lean toward the idea of having the steam reach the radiators at about atmospheric pressure and use the vacuum pump as a means of removing the air and condensation. Even in this case it will readily be seen that a more equable heat distribution would result if the same pressure differential could be maintained between both sides of the radiator traps at every radiator on the system. Unfortunately, this is not the case, since both the steam pressure and the vacuum decrease as the distance from the pump and boiler to the radiator increases, and extremely remote radiators are sometimes found operating as low-pressure units.

It is generally admitted that the vacuum decreases with the length of horizontal run but many have the impression that in the extremely high risers the vacuum is increased by the rapidly falling water and condensation. This can hardly be true, for with the size of pipes used in the returns the rate of flow can be but a fraction of a foot per second.

The acceleration of velocity of a fluid falling through a pipe when the pipe is not completely full reaches its maximum after falling but a few floors.

It is therefore necessary that the pump carry a greater vacuum than that desired at the radiator traps. To decide what this maintained vacuum should be again leaves us to the mercy of the many variables. In practice, 8 in. seems to meet general conditions. The pumps are code rated as being able to maintain a certain vacuum against a certain dimensioned opening but this can only apply to the pump itself and not to the varying system conditions.

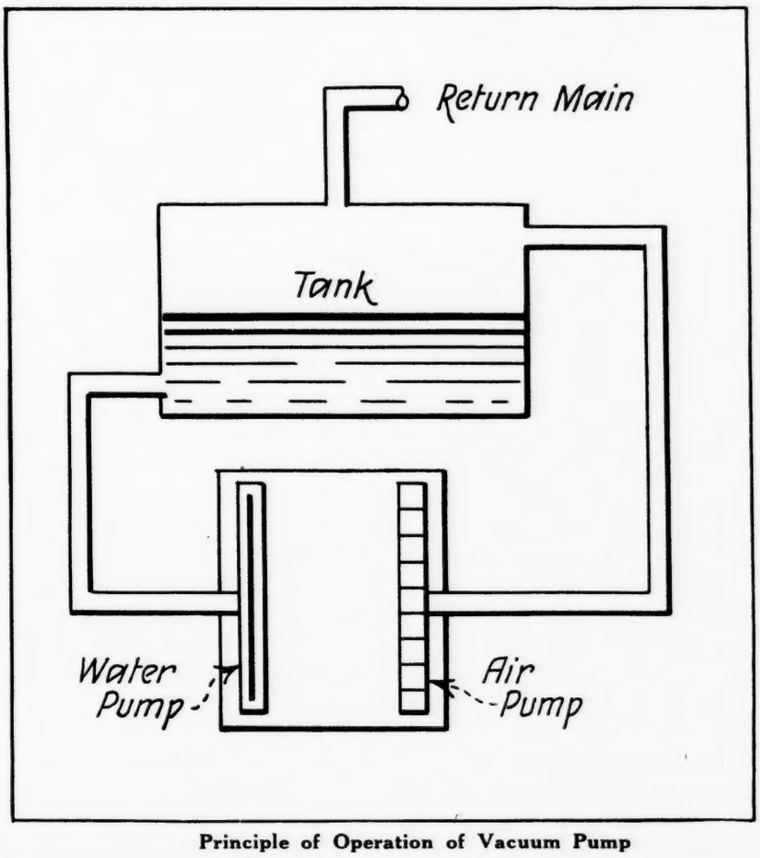
While the reciprocating pump is fairly well understood, centrifugal pumps with separate units for air and water are being increasingly used and a short description of their operation may be of interest. The drawing shows a diagrammatic sketch of the receiving tank and the two pumping units. The air impeller is operated by a vacuum control and the water is controlled by an upper and a lower level float valve.

On starting the system the air pump operates until the desired vacuum has been attained. Then, as the condensation flows into the tank it finally reaches the upper level, when the action of the float valve starts the water wheel which lowers the water in the tank to the lower float valve and the pump stops. Provision is made so that sufficient vacuum is created in the water wheel housing to overcome that in the tank so that the water will flow to the pump.

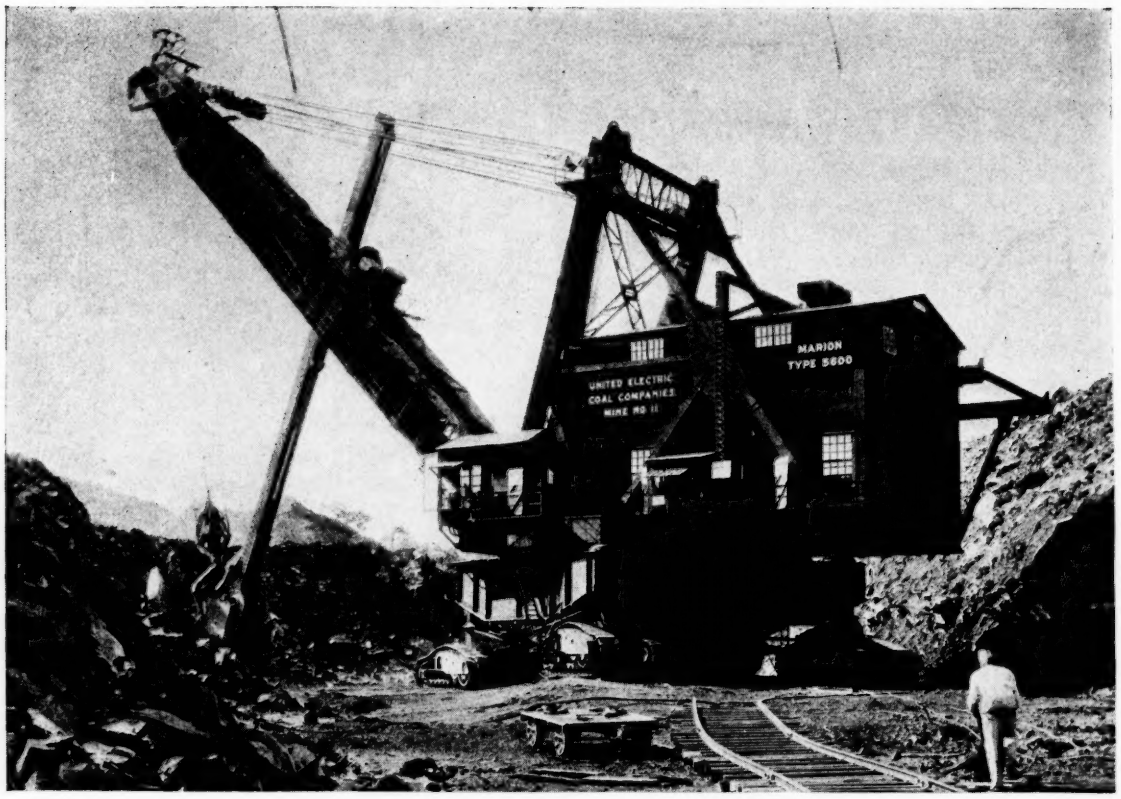
During this process, and while the water of condensation is accumulating in the tank, the vacuum in the upper section is slowly decreasing, and the gauge may register several inches less than at first. As the water is drawn out this again increases the vacuum and the gauge will be seen to climb and sometimes reach a higher point than it did originally. Thus it is seen that the water pump also helps maintain the vacuum. This operation obtains for several times but with the vacuum each time reaching a lower stage until it finally falls below the vacuum setting, when the air impeller again operates and exhausts more of the air and vapor.

To one accustomed to any certain pump this ratio of operations between the air and water members can be made an index to the leakage in his system. Thus, in a well-fitted system if it is found that there are three or four operations of the water pump to one of the air it would be an indication of leakage or infiltration in another system where the ratio would be less than this.

Consequently, the differential pressure in a system equipped with a vacuum pump is the sum of the pressure created at the boiler and the vacuum maintained by the pump. This same differential could be created entirely by the boiler and have the return at atmospheric pressure. In the case of steam being furnished by a central station from which it can be conveyed at a high pressure to any part of the building and reduced to any desired pressure to the radiators, there is scarcely any logical reason, outside of a slightly higher radiator temperature, why a vacuum pump need be used *in so far as the heat distribution is concerned.* They are, however, so used and do give satisfaction. Their function then seems to be more toward the positive removal of the condensation overcoming any air pockets or errors of poor alignment in the return piping.



Principle of Operation of Vacuum Pump



Veins of Coal Near the Surface Are Stripped by this 1600-Ton Shovel whose Dipper Holds 20 Cu. Yds.

Automatic Heat and the Bituminous Coal Industry

by **K. C. RICHMOND,**
Managing Editor, Mid-west Coal Retailer

TODAY, the future of the bituminous coal industry is brighter than it has ever been.

To be sure, it has been criticized and abused, but, as the United States Bureau of Mines points out in a recent publication, "It seems clear that the total demand for power and heat in all forms, which is still increasing at a wholesome rate, may be expected to continue to increase. It will not only grow with population, but the per capita consumption will probably increase.

"It is also clear that whatever of this total demand for energy is not supplied by oil, gas, and water power will fall back upon coal. The possibilities of water power are limited. The great variable, the most uncertain factor in the future of coal, is the consumption of oil and gas. Most observers expect the production of petroleum to decline sooner or later, and when it does, a great increase in coal consumption may be anticipated.

Bituminous coal producers and retailers are following aggressive merchandising policies and promoting sales of small stokers. They are cutting production costs. They are servicing heating plants. The result is that the use of bituminous coal in domestic installations is increasing.

The methods by which this industry is working out its salvation are remarkably similar to those being followed by the anthracite producers and merchants, outlined by Noel Cunningham in Heating and Ventilating for November, 1929.

"As to the factor of fuel economy, all will agree that the present rapid rate of improvement in fuel efficiency is not likely to continue indefinitely. The progress, since 1917, is largely a taking up of slack, a general adoption of principles already known to engineers. On the other hand, the advances in efficiency give no promise of terminating abruptly, for there is still room for great improvement in bringing average performance nearer to the level of what the best performance has already indicated is possible.

"The consumption of bituminous coal for heating houses and other buildings appears to be increasing. Not only does the percentage devoted to this purpose increase, but the tonnage actually consumed as well.

"Not merely is population increasing, but the per capita consumption of fuel for heating is increasing. Higher standards are maintained in

American homes, and more fuel is required to keep people warm outside their homes. Children spend a longer period in school, more women work outside their homes, and people spend a larger proportion of their time in places of amusement. All this increases the heating load. The per capita consumption of coal (anthracite as well as bituminous) for 'domestic and all other purposes' has increased between 12% and 20% since 1909.

"Most of this increase in the heating load has gone to bituminous coal rather than to anthracite. The large buildings tend to use bituminous and the anthracite sold is concentrated more and more on the heating of houses, for which purpose it is admirably adapted. The expansion of bituminous coal in this field is doubtless assisted by the increasing proportion of the total population living in apartments.

"The result is a net increase in the tonnage of bituminous coal used for domestic and other heating, an increase that is reflected in the active interest in screening and sizing which is apparent in many mining districts."

During the war, the bituminous coal industry expanded its productive capacity to take care of the tremendous increase in the demand for coal. Problems incident to and following the war-time expansion to productive capacity have since been solved to a large extent.

In the readjustment, many mines were shut down and some operators went out of business. Thousands of coal miners turned to other work. Several mergers and consolidations were made.

Competitive fuels became active during this readjustment period. Oil, in particular, made some big inroads in the domestic coal market. New natural gas fields were opened up in some sections of the United States, displacing considerable coal.

Whenever the householder has trouble in keeping the home fires burning the coal man gets into difficulties. The trouble, of course, is usually due to bad chimney conditions, cheap, poorly designed or installed furnaces, or to equipment that needs repairing. In many cases, what is needed is replacement of equipment.

Retail coal merchants long since became service men for the entire heating industry (oil burners and gas-fired equipment excepted) not because they wanted to encroach on the heating trade's business, but because the home owner has turned to them whenever heating troubles developed.

Coal men are fixing chimneys, sealing up leaks, putting in new grates for numerous home owners with or without charge—even extending vacuum cleaning service for boilers and furnaces. This last service is being furnished by several hundred progressive retail coal merchants.

With so much hopelessly antiquated and inconvenient heating equipment in use, it isn't strange that the public welcomes the use of oil and gas burners. Since we know that over 60% of all the oil burners in the United States are found in only eight middle western states, it is not surprising that the coal trade in the Middle West has so enthusiastically welcomed the small stoker, the means by which home owners can now secure automatic heating with coal conveniently and at small cost.

If the heating industry in general had really been on the job, authorities in the coal industry declare American home owners could have had temperature control, automatic firing, provision for the maintenance of adequate humidity, and smokeless equipment years ago. A heating plant that does not offer such advantages is by no means modern.

While the thermostat is not new, the heating industry apparently did not recognize it until comparatively recently—at least to the point of merchandising temperature control. Humidity control is still largely ignored.

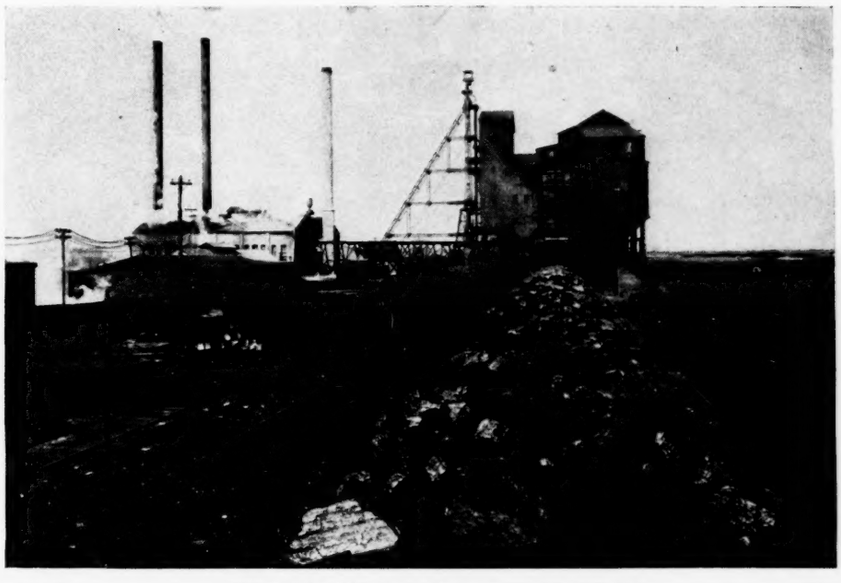
To all intents and purposes, the factor of convenience has been almost entirely overlooked, much to the misfortune not only of the home owner but to the bituminous coal industry as well.

Consequently, the coal trade has commenced selling stokers. Several manufacturers and the majority of the dealers of smaller stokers are composed of and are financed by coal men who have pioneered the way. Rapid progress is being made. Sales for 1929 will probably be three times those of 1928.

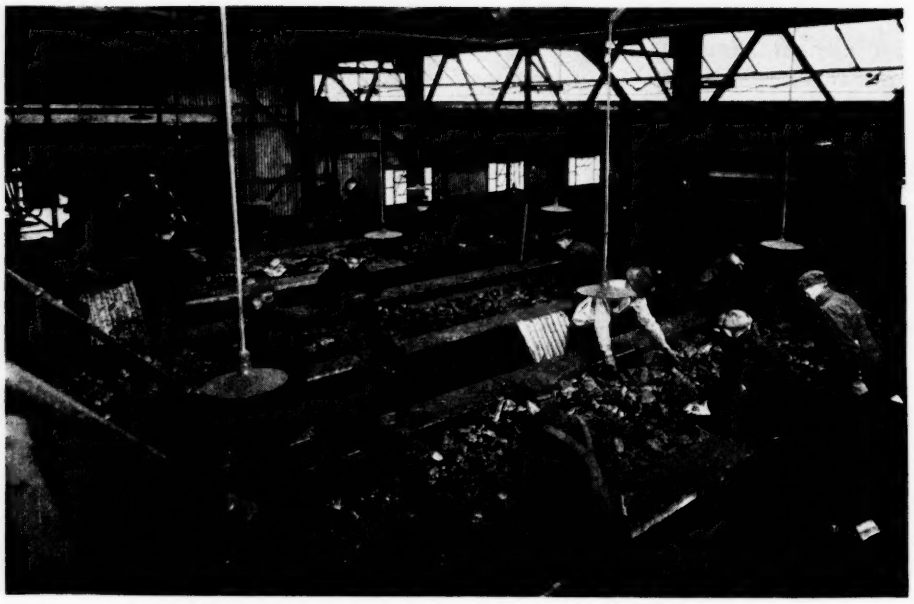
In addition, a few furnace and boiler manufacturers have seen the light and are either selling or planning on adding stokers that can be sold as an integral part of a new heating plant or as a specialty for present installations.

Only one real limiting factor has affected the production and sale of stokers thus far— man-power. It takes time to find men and to train them to sell stokers and to line up others to install such equipment properly.

In the old days coal operators were usually "production minded" but at the present time merchandising has come to be appreciated. A trip through the mines of Southern Illinois, for instance, discloses the finest equipment that money can buy. Here the visitor will find single mines that



Typical Mid-Western Bituminous Coal Mine



Picking Rock and Slate from Coal at the Picking Tables

produce from 7000 to 15,000 tons of coal daily. Mine tipples embodying the ultimate in equipment to clean, size, and prepare coal, are found by the dozens.

In Indiana, Kentucky, and West Virginia also are found mines that are likewise as well equipped for their particular work as the automobile factories in Detroit.

Unfortunately, the "old school" put tonnage first. Getting out the coal seemed more important than getting a profit. Finding that tonnage alone doesn't mean a profit, members of the industry naturally began turning to merchandising.

For several years, farsighted members of the bituminous coal industry have been doing some effective merchandising. Engineering service was made available to fuel users years ago by some producers who felt it would pay to follow through and help their customers get the most out of the coal they bought.

Today, virtually every outstanding bituminous coal producer and many retailers employ combustion or fuel engineers who are at the service of the coal user. Some of these men are literally consulting engineers on boiler and power plant equipment. They run boiler tests, educate firemen, act in advisory capacity, inspect power plant equipment, and study operating conditions, to the end that customers may get the greater satisfaction or efficiency from the coal purchased.

Engineering manuals, charts, and special literature have been placed in the hands of coal users, not only by individual coal operators and dealers but by the various coal service bureaus or coal institutes such as that at Kansas City.

In Utah, the Coal Producing Association, in cooperation with the Extension Division of the University, has prepared a home-study course in "Coal and Its Utilization"—a course that is attracting considerable attention in that section.

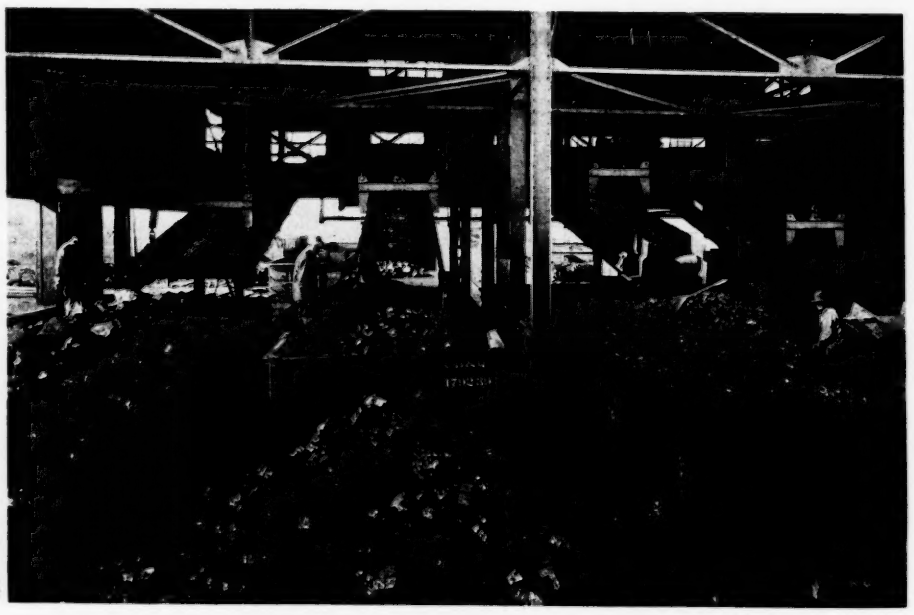
In Kansas City, Mo., the retail coal trade is going to school—getting together at night to study combustion problems—thanks to the activity of the Kansas City Coal Service Institute. The engineers connected with this organization are at the service of fuel users generally, irrespective of the type of fuel used.

The National Coal Association in Washington, D. C., has just issued a report on small stokers for widespread distribution. A few weeks ago, the same organization put out a second report on pulverized coal. A "World-Wide Picture of Bituminous Coal Research" was issued last fall. This report indicates that a surprising amount of research relating to coal is being carried on throughout the world.

Fellowships are financed by the association to further the utilization of coal. Much distinctively farsighted and constructive research work is being planned by various coal organizations.

Throughout the country, while it must be admitted some coal men are not on the job, the progressive element is conscientiously trying to keep pace with the procession. In Chicago, "Certified Heating" was discussed by the Coal Merchants Association recently. Coal men are vitally interested in the general adoption of "Certified Heating" and of the "Standard Code" covering the installations of warm-air furnaces.

By active cooperation with existing agencies in the heating field and for the good of all concerned, the bituminous coal industry looks forward to the future with confidence —a confidence based on a knowledge of its availability, and on its economical utilization by means of modern equipment.



Loading Booms that Can Readily Be Raised or Lowered to Prevent Breaking in Loading Coal

Estimating and Designing Heating Systems

Part V—An Example of Unusual Conditions in Hot Water Layouts

by **FRED W. HANBURGER**

Special Lecturer on Heating and Ventilation, College of the City of New York

HAVING covered the theory of gravity hot-water heating, we are ready to take up design. An example of actual installation is presented in the following.

This example is rather worthy of note as an illustration of why it is sometimes necessary to depart from the conventional form of design. It is an actual layout as designed for and installed in the residence of Alfred F. Evans, an architect, at Great Neck, Long Island.

The building is cozily fitted to the hillside on which it is located and, owing to the lower surface elevation at the rear, as shown in Fig. 18, has several ideal bedrooms, a bath and a hall, and a garage in the basement. The radiators in these basement rooms being below the average water height of the boiler, have no effect, in themselves, of producing circulation and must be supplied with and heated with the return water from the upper radiators.

This was best accomplished by what is termed a reversed flow. Thus, in the circuit to the dining and living rooms, it will be noted that there is a supply only from the boiler to the first radiator (the dining room) branch, but sufficiently large to carry all the water of the circuit.

The return from the dining room then is carried along with the supply main and becomes increasingly larger as more of the radiators are added to it, while for the same reason the supply main is diminishing until it disappears entirely at the last radiator of the circuit from which there is a return main only to the boiler.

So that the system would be readily adaptable to all weather conditions, a radiator temperature drop of only 20° was used. By using top radiator connections on the first floor radia-

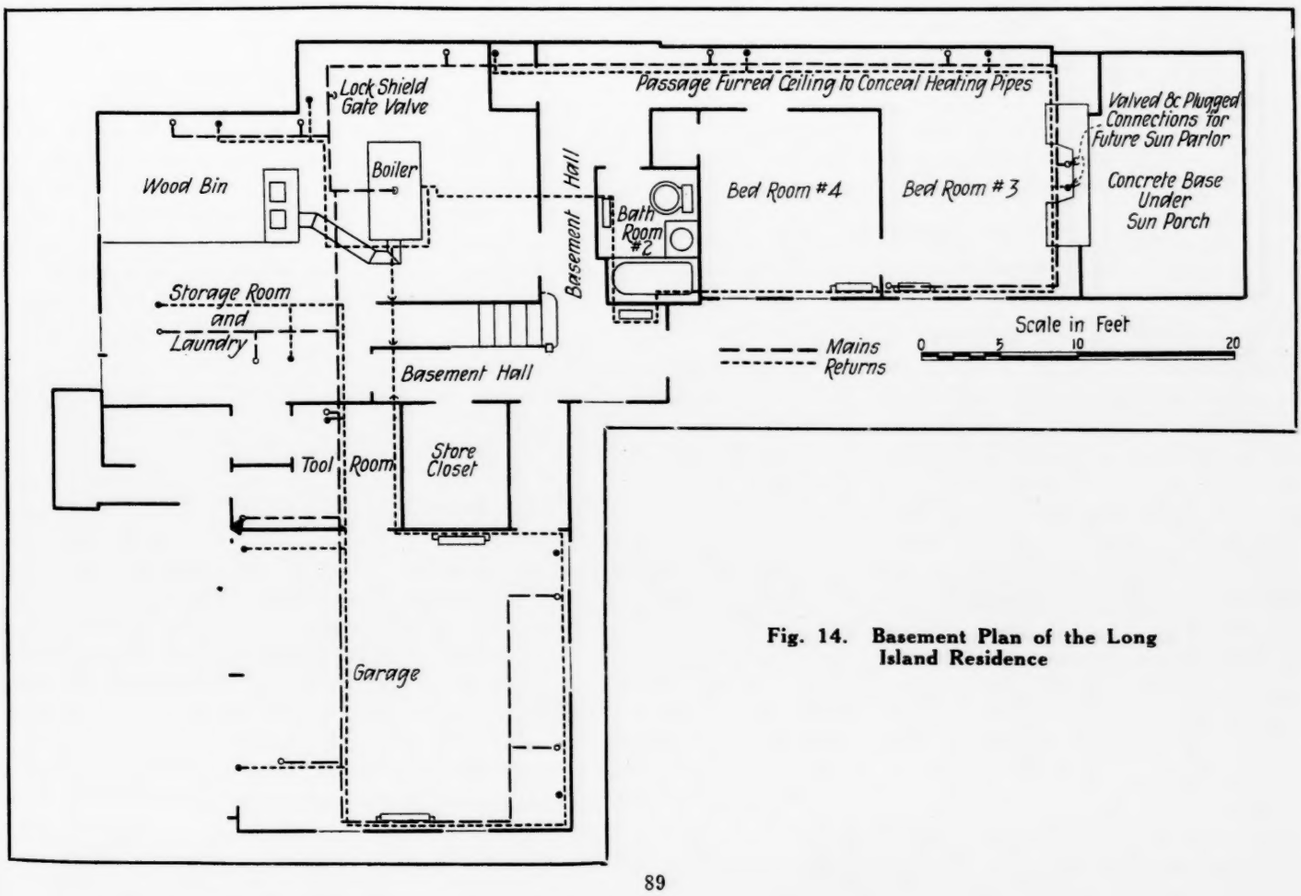


Fig. 14. Basement Plan of the Long Island Residence

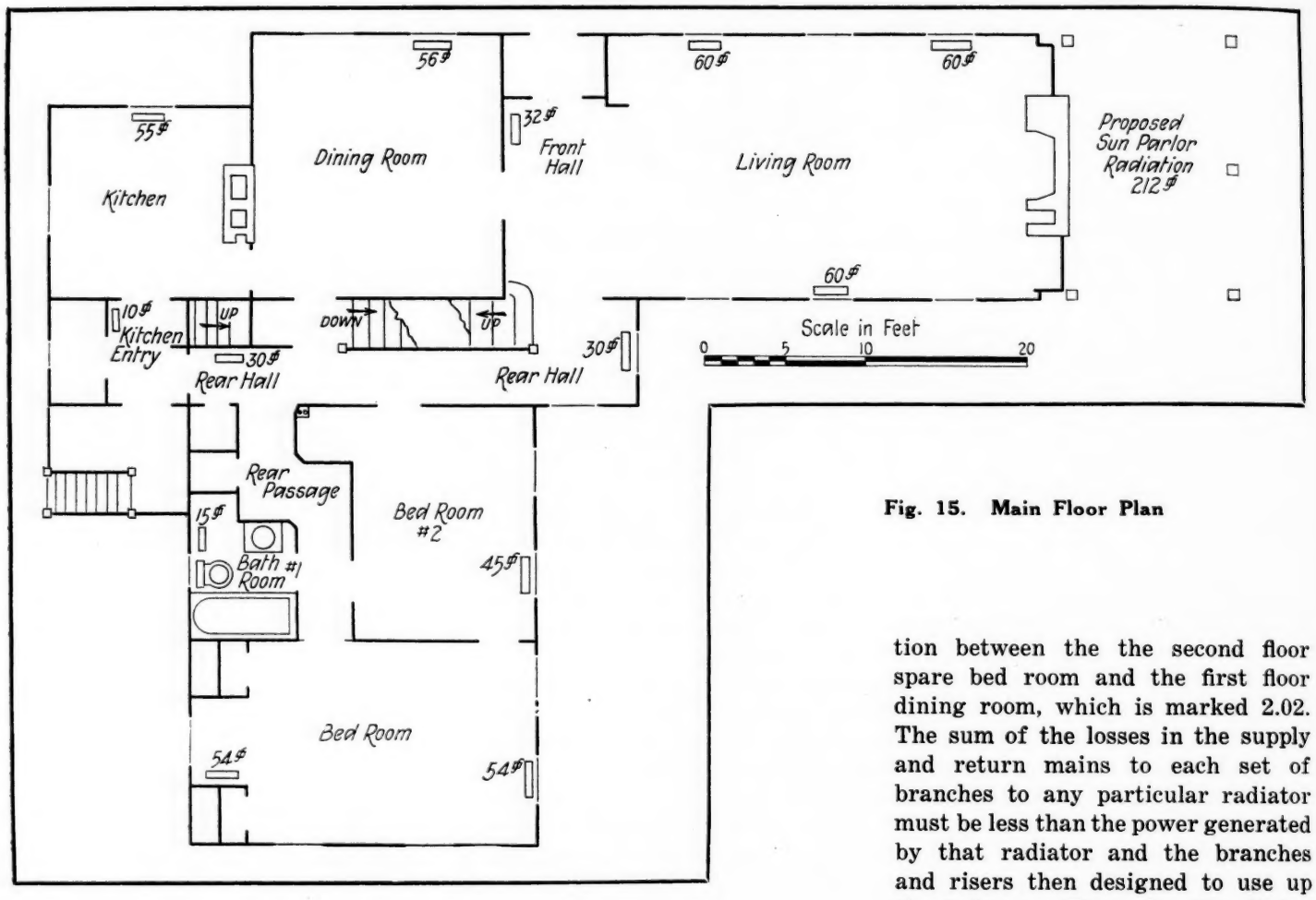


Fig. 15. Main Floor Plan

tors, and with the high basement ceiling, a generating height of 8 ft. was obtained for the first floor, and 16 ft. for the second. This gives an available friction allowance of

8 ft. x 0.42 lbs. per sq. ft. per ft. = 3.36 lbs. per sq. ft. for radiators on the first floor, and

16 ft. x 0.42 lbs. per sq. ft. per ft. = 6.72 lbs. per sq. ft. for those on the second.

Friction loss along the supply main, branches and risers from the boiler to any one radiator plus the friction loss in the return main, branches and risers from that radiator to the boiler must be equal to the power generated by that particular radiator. This condition must be true for every radiator on the system. Possibly the easiest method of attaining this is as follows:

Taking the dining and living room circuit as an example, the total length of the main circuit scales to 260 ft. Making a tentative allowance of 100 ft. for fitting resistances we have an approximate equivalent length of 360 ft. and therefore an approximate friction loss of

$$\frac{3.36 \text{ lbs. per sq. ft.}}{360 \text{ lin. ft.}} = 0.009 \text{ lbs. per sq. ft. per lin. ft.}$$

The amount of water flowing in each section of the supply and return mains is then noted and tentative pipe sizes taken from the flow chart, Fig. 5 (Page 68, December, 1929), for this friction loss of 0.009 lbs.

After these sizes are noted the exact friction must now be calculated. Starting from the boiler and working along the supply main it is estimated for each section and the accumulated amount to each branch entered on the plan. They are indicated in circles in Fig. 16. This is continued to the end of the supply main, in this case the last radiator of the living room, where the friction loss is 2.09.

Similar results are obtained and noted from the boiler back along the return main. Friction losses in the returns are underscored to distinguish them from those on the supply. This is continued until the first branch to the first radiator of the circuit is reached, in this case the T connection between the the second floor spare bed room and the first floor dining room, which is marked 2.02. The sum of the losses in the supply and return mains to each set of branches to any particular radiator must be less than the power generated by that radiator and the branches and risers then designed to use up the balance. Thus, for the dining room radiator, the sum of the flow and return friction to its branches is

(0.92 + 2.02) lbs. per sq. ft. = 2.94 lbs. per sq. ft. leaving

(3.36 — 2.94) lbs. per sq. ft. available for friction in the branches, risers and connections to the radiator which must be sized to create this friction. In this case it is satisfied with a 1½-in. supply and a 1¼-in. return. For the spare bed room on the second floor, the generated power for which is 6.72 lbs. per sq. ft. the procedure is similar. The total friction to the branches is

(0.98 + 2.02) lbs. per sq. ft. = 3.00 lbs. per sq. ft. leaving

(6.72 — 3.00) lbs. per sq. ft. = 3.72 lbs. per sq. ft. to be used to and from the radiator. The 1-in. branch and riser does not throttle sufficiently, but it will be found that by using a ¾-in. valve and nipple this is satisfied.

All the branches and risers on the circuit are sized in a similar manner. As the returns drop to the basement floor, the lower radiators are connected as shown in the detail. Owing to the lower temperature of the water the radiating surface of these radiators must be increased. Thus, for

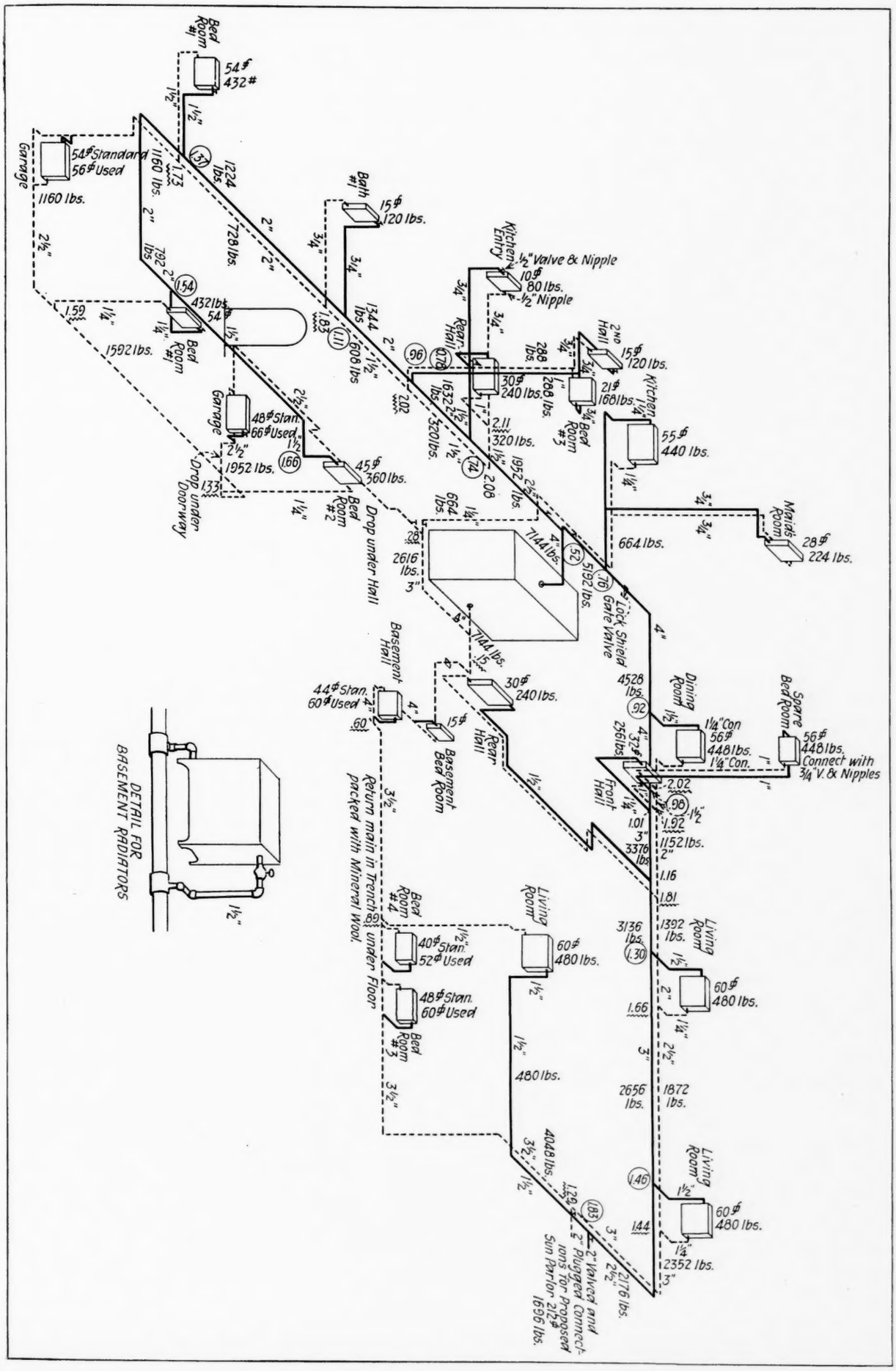


Fig. 16. Isometric Diagram of the Water Heating System

the radiator in bed room No. 3 where 48 sq. ft. of standard radiation is normally needed, this must be increased to 60 sq. ft.

On the working plan this latter figure is the only one given but the other figures are marked on the sketch for the benefit of the student.

Another feature on this same circuit is that there is a block of 212 sq. ft. of future radiation to be installed at a later date in the proposed sun parlor. The mains were designed as though this radiation was already in place so that no later changes need be made. The amount of water flowing in this circuit, then, is less than designed for and the friction will be less than is needed for a proper balance.

This is corrected by inserting a lock-shield gate valve somewhere in the circuit which must be set to create as much friction as the sun porch radiation would produce. The method of setting this valve is at an initial firing-up period when the valve is closed gradually so that the radiators on this circuit will heat simultaneously with those on the other parts of the system.

Other circuits on the system are then sized in a similar manner.

There is an independent circuit supplying the kitchen and maid's bedroom which does not operate as a reversed flow. It makes no difference what method or combination of methods we use so long as the friction loss is kept reasonably balanced.

The student should check the pipe sizing in the remainder of the system so as to become familiar with the method and degree of precision necessary. Use of reducing fittings was avoided throughout the system.

This article completes the text on gravity hot water systems, and forced or mechanical systems will be discussed at a later date. The author will cheerfully answer any questions that may be asked. In the next issue we will take up the discussion of heat and heat losses.

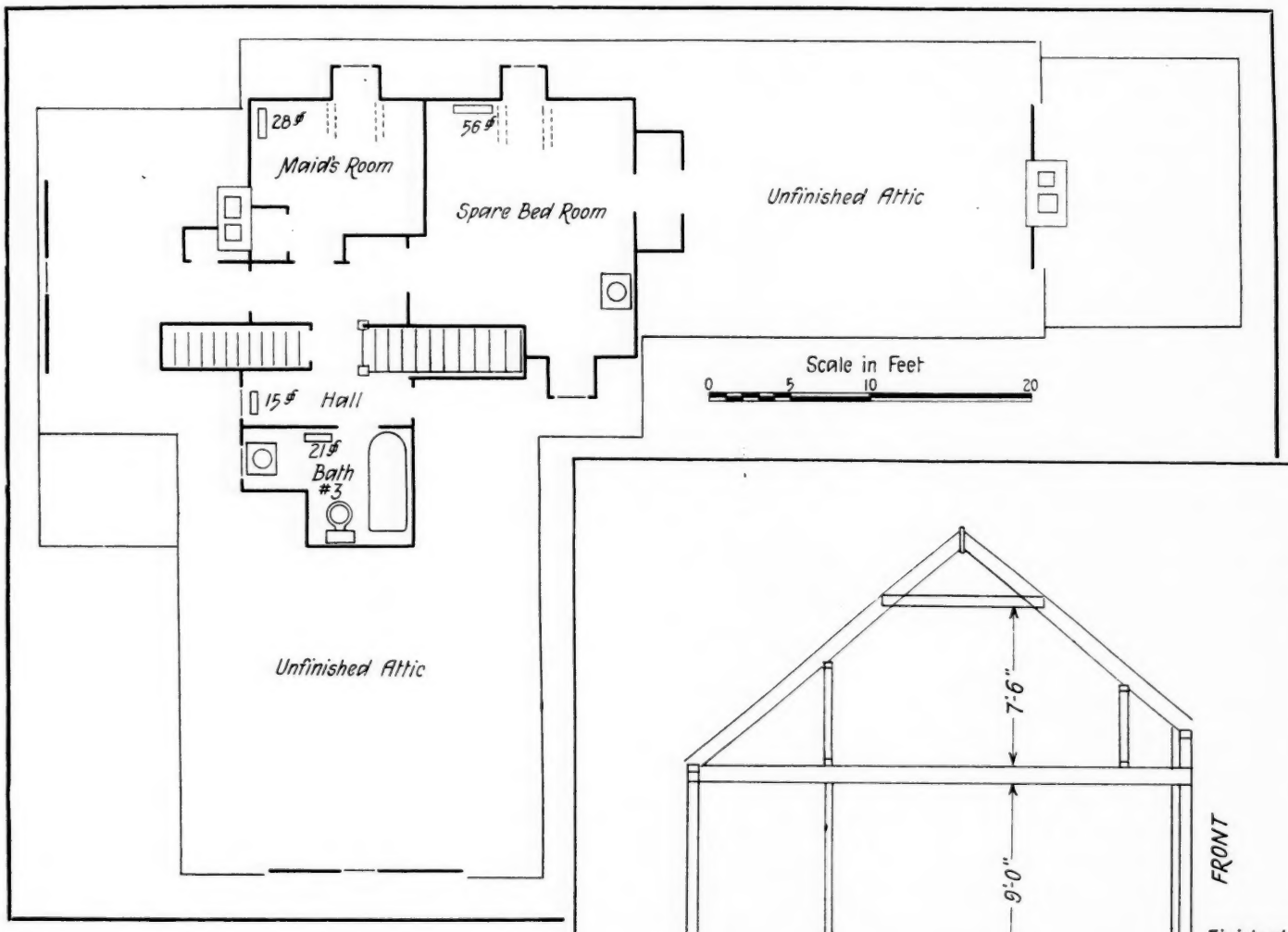


Fig. 17. (Above) Attic Floor Plan

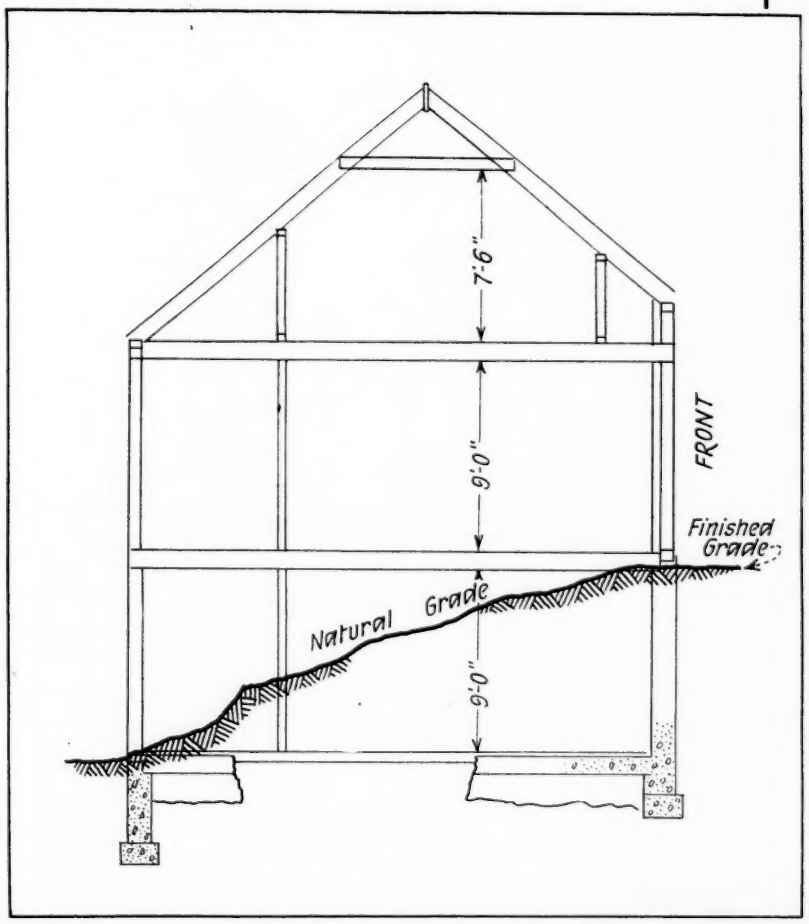


Fig. 18. (Right) Elevation of the Residence Showing Grade Line

Heating Troubles I Have Met

by the **TROUBLE ENGINEER**

5—A Vapor Heating System Fails

A HEATING contractor—one who is known for good work at a fair price—called on The Trouble Engineer for help, requesting him to go over a troublesome vapor heating job installed in a large building. The heating contractor had spent a great deal of money to make it function satisfactorily.

A number of changes suggested by different parties had been carried out but with no satisfactory results. The owner refused to pay for the job. Following is the layout:

A large three-story building, with heated basement, auditorium and office space on two floors, was heated from a cast-iron sectional boiler installed in the basement. The vapor system heated this building, as well as an adjoining residence (see Fig. 1). At the side of the boiler an air eliminator and return trap was located as shown in Fig. 2.

Pipe coils were used in the basement and cast-iron wall radiation was used in the auditorium. Water-type radiation was installed in all the office space above, with supply valves at top and traps at bottom of all coils and radiators.

In going over the job, it was found that the auditorium could not be heated at all, due to air binding, but the offices could be heated if the auditorium were shut off. This seemed to indicate insufficient boiler capacity or that the steam main was too small.

After a thorough check-up of the entire building, we were convinced that the boiler capacity was ample and radiation, as well as pipe lines, well laid out and properly placed. The chimney also proved to be of sufficient size to produce the required draft.

At the side of the boiler a return trap was installed and to this return trap all the returns from both buildings were connected in such a way that, so long as the steam pressure remained low, the condensation would return by gravity to the boiler, without going through the return trap at all. (See pipe P, Fig. 2).

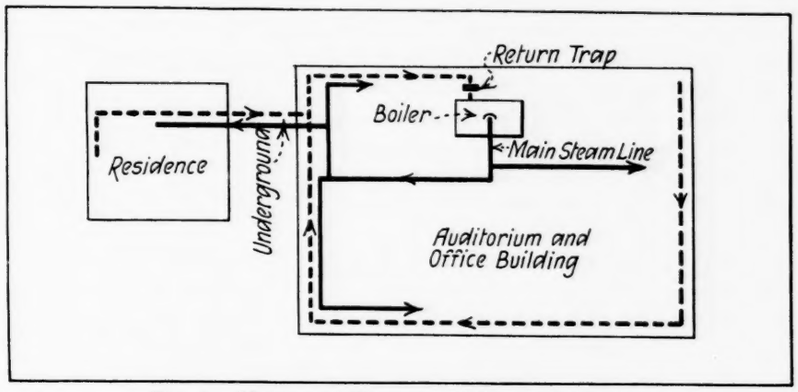


Fig. 1. Mains and Returns of Vapor System in a Three-Story Office Building

When the steam pressure reached 1½ lbs. the static head was not sufficient to overcome the boiler pressure and all the condensation had to enter the return trap. When the return trap was filled, the float in this trap would trip a lever, opening the steam valve L (Fig. 2) admitting boiler pressure to the trap. The pressure being equalized, condensation then flowed through pipe Z (Fig. 2), closing check valve R and opening check valve S into the boiler.

The general complaint on the job was that the pipe coils in the basement and all the wall coils in the auditorium would not heat. Condensation from the residence to the north of the main building would not flow back to the boiler, causing pounding, air binding and insufficient heating. Another complaint was that when the boiler pressure exceeded 1½ lbs. the water would leave the boiler gradually. A multitude of troubles, to be sure.

As mentioned before, 1¼-in. pipe coils were installed in the basement and connected as shown in Fig. 3. A check-up revealed that only two or three coils were hot, while the rest

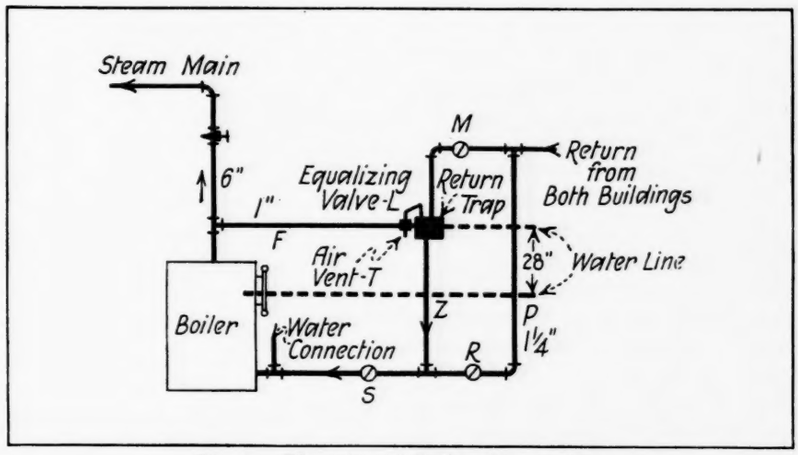


Fig. 2. Elevation of Boiler Connections

were cold. Each coil had a total radiation of 260 sq. ft. and the coils were about 60 ft. long. Why such long coils were installed we do not know. They covered almost the entire wall surface. The connections to these coils are shown in Fig. 3. They proved to be insufficient to supply to coils and distribute the steam equally.

After the supply connections on all the coils had been changed as shown in Fig. 4 and a thermostatic air vent ¾ in. in size placed on top of the return header on each coil, the basement coils worked for a while and then cooled down in about an hour. However, this happened only when the steam pressure was raised above 1½ lbs.

We had gained a point by making the change but this did not seem to be of lasting value. We then decided to leave the coils alone for the time being and concentrate on the wall radiation in the auditorium, thinking that the coil trouble was caused by the steam blowing through the traps on the wall radiators.

In the auditorium, we found the wall radiation connected as shown in Fig. 5. It heated only about 3 ft. from the supply end. This was due to the fact that the trap was located on the same end as the supply valve and the steam, following the line of least resistance, passed through nipple C (Fig. 5), closing the thermostatic disc in the trap D, thereby pocketing the air in the rest of the coil which prevented its heating.

To correct this trouble we removed the trap D and placed it on the opposite end of the wall radiator, as shown in Fig. 6.

The reason why the trap was placed as shown was that wall E, being only 3 in. from the radiator, did not allow the trap to be placed conveniently. It was necessary to make the connection shown at F in Fig. 6 in order to place the trap on the end opposite the supply where it belongs. After this change was made, the wall coils in the auditorium became hot, but only when the basement coils were shut off.

The trouble with the heating of the residence was next investigated, because it seemed as if this trouble was caused by the pipe coils in the basement or that the trouble with the pipe coils was caused by the residence radiators or piping in-

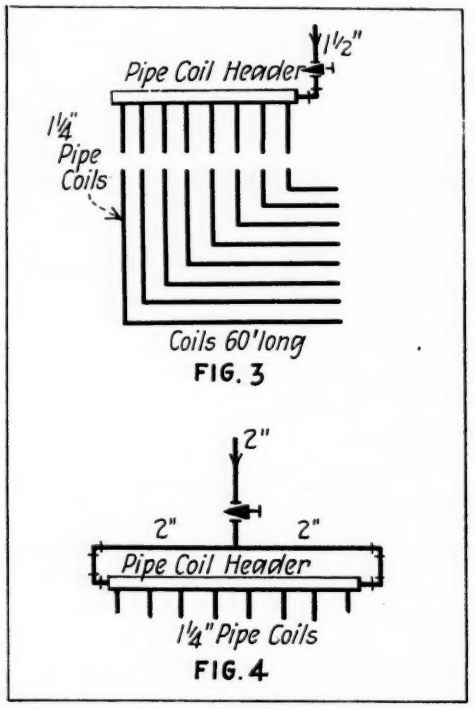


Fig. 3. Pipe Coil Connections as Installed
Fig. 4. Pipe Coil Connections as Changed

stallation. A complete and thorough examination of the residence layout, radiators, return-line traps and supply valves showed everything to be in first-class condition. This left only one place to look for the trouble and that was the air eliminator and return trap alongside of the boiler.

This trap apparently was functioning properly, because the steamfitter, who crawled into the small space, assured us that there was 6 in. of water in the glass of this trap. He argued that if the trap was not functioning properly, the water from the returns could not enter the boiler.

We reminded him of the fact that the water would not have to enter the trap as long as the pressure remained below 1½ lbs. and when over this, we had trouble which, no doubt, was caused by the return trap. When we removed and disassembled the trap we found that the float in the trap was partly unscrewed from the stem, thus striking the inner wall of the trap body. In this position, the equalizing valve L (Fig. 2) remained open slightly, allowing enough steam to enter the return trap body from the boiler line F to keep the check valve M closed, air vent T being closed also. Thus no condensation could enter the trap, causing the trouble with the basement coils and the residence, because they were the lowest and, consequently, the first to be affected.

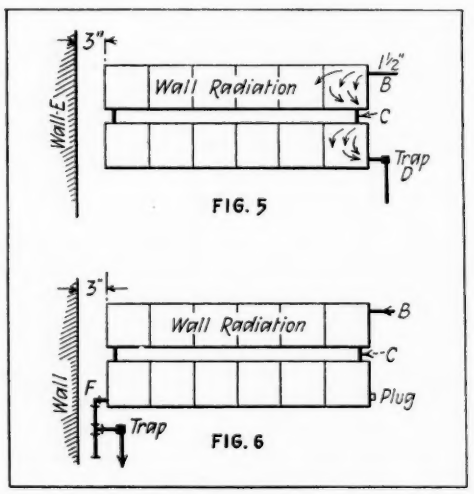


Fig. 5. Wall Radiators in which Steam By-Passed Most Sections
Fig. 6. Connections After Change

It must be remembered that as long as the steam pressure remained low, the condensation entered through pipe P (Fig. 2) but, as soon as the pressure increased the static head was not sufficient to force the water from the return line into the boiler. The reason why we found 6 in. of water in the gauge glass of the trap was due to the fact that some one had closed the lower gauge cock.

After the return trap was put in a first-class working condition and reinstalled, the entire system functioned satisfactorily and every radiator remained hot at low, as well as at 10 lbs. pressure, including the pipe coils and wall radiation.

The reason why the office radiators functioned at all times was that as soon as the pipe coils and wall coils were shut off, the condensation from the office radiators piled up in the return line, thus creating a greater head, allowing the condensation to return to the boiler through the direct return line, (see P, Fig. 2). As shown in this case, even first-class installations may cause serious trouble if the little details are overlooked and seemingly unimportant items passed up.

Use of Natural Gas in California to Be Increased

Eighty per cent of all gas consumed in the State of California is natural gas. At the present time there are under construction a number of projects which are expected to be completed within the next 12 months. Upon the completion of these additional projects, the area served with natural gas will be greatly enlarged and about 98% of all of the gas used will be natural gas.

Control of Humidity and Temperature

As Applied to Manufacturing Processes and Human Comfort

by **WILLIS H. CARRIER,**
President, Carrier Engineering Corporation

IV

Systems of Dehumidification

IN many industries, as already pointed out, it is as important to control the temperature in summer as in winter and, at the same time, the relative humidity must be controlled both summer and winter, the air being warmed and the humidity increased in winter, and in the summer the air must be cooled and dehumidified so that both temperature and humidity may be held at a definite point regardless of outside weather conditions, or conditions within the plant itself.

The design of air distributing equipment and the external appearance of such equipment is the same as described for systems of humidification. The main differences are to be found in the internal construction of the dehumidifier, in the use of refrigeration as well as heat for controlling the water temperature, and difference in the general methods of control.

Dehumidifiers are of two general types. *First*, the spray type in which the water is cooled outside of the spray chamber and then introduced. *Second*, the type in which the refrigerating coils are placed directly in the spray chamber and the water is sprayed over this surface, air coming in contact both with the wetted coils and the spray.

Both types of dehumidifiers have air distributing baffles at the inlet and eliminators at the outlet. The dehumidifier is usually considerably longer than the humidifier and in the spray type there are two sets of sprays, one or both of which is opposed to the air flow.

The individual spray nozzles are considerably larger in capacity than the spray nozzles used in the humidifier and operated at a much lower pressure, usually from 20 to 25 lbs. per sq. in., the object being to get a coarser spray and, at the same time, a much larger quantity of spray per unit of air to be treated than in the humidifier.

An exceedingly finely divided, or atomized, spray is not so effective in dehumidification as there must be provided heat capacity as well as surface in the spray water. The usual allowable rise in spray water temperature entering and leaving the dehumidifier is from 6° to 10° F., and in well-designed dehumidifiers of the spray type the final temperature of the air is substantially identical with the final temperature of the leaving water. This is made possible by the counter flow effect employed in such apparatus. The velocities through the dehumidifier are usually lower than those employed in the humidifier, normal velocities being from 400 to 550 ft. per min. under the cross sectional area.

Greater care must also be taken with the elimination of free water than with the humidifier as an entrainment beyond the eliminator defeats the purpose of the equipment.

Dehumidifier systems are usually provided with two essential control elements, a dew-point control at the apparatus and a room control. The former maintains a uniform temperature of saturated air leaving the dehumidifier at all times of the year. In summer, in industrial work, this is so constructed as to use nearly all return air, thus reducing the refrigerating load required, while, when the wet-bulb temperature outside is at all below the dew-point required within the room, the latter is controlled by a mixture of fresh and return air as required under control of the dew-point thermostat.

By the second element the temperature in the room is independently controlled at a definite point above the dew-point or saturation temperature, either by a thermostat or a hygrostat, depending upon whether the most important factor is the temperature or the relative humidity. Such control either operates upon volume dampers controlling the quantity of air introduced, or upon heaters which supply the necessary heat for temperature regulation. Usually the control is a combination of both volume control and the heating of the air.

In auditorium installations the requirements are quite different, since there must be a considerable volume of air circulated for ventilation and cool-

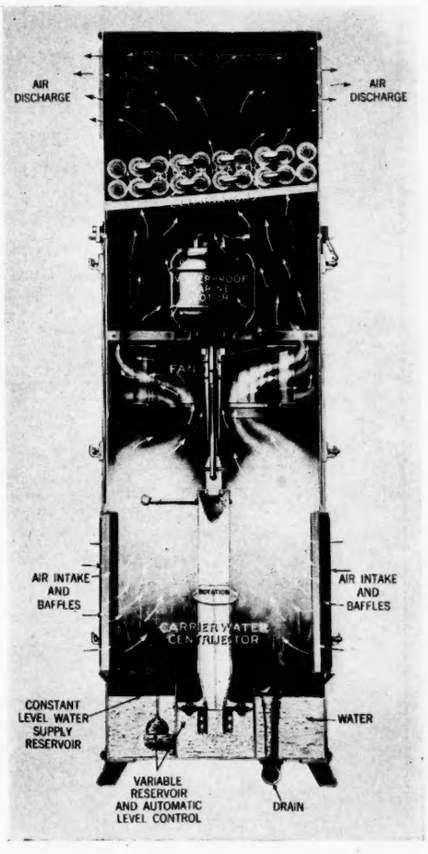


Fig. 8. Phantom View of Interior of Unit Conditioner

From a paper presented at the World Engineering Congress, in Tokio, Japan, November 7, 1929.

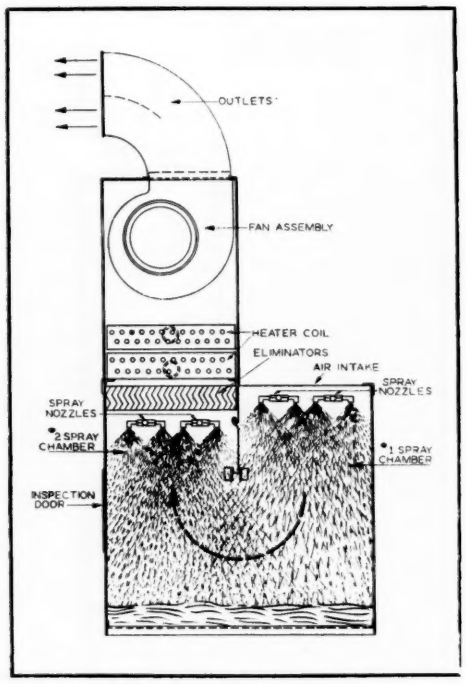


Fig. 9. Sectional Elevation of a Unit Air Conditioner

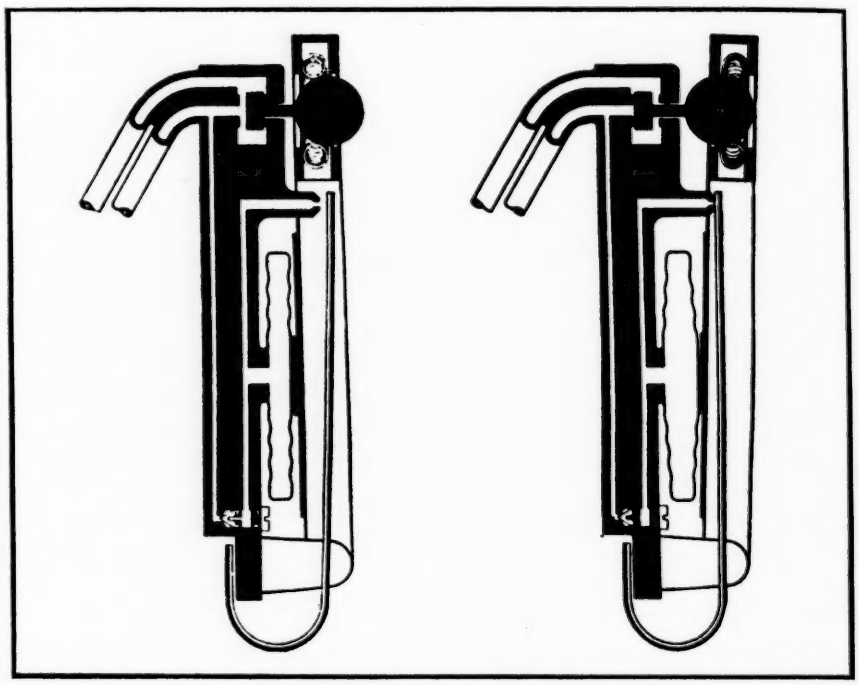


Fig. 10. Open and Closed Positions of a Bi-Metal Thermostat

ing purpose and for effective distribution. The moisture content must be relatively constant, but its temperature varies according to the requirements of the auditorium. Satisfactory solution of this problem has proved difficult, but special systems of control are now in general use which permit the temperature and humidity to be controlled independently in the auditoriums and, at the same time, to be immediately responsive to changes in occupancy, and for the most part without the use of any external heat.

Systems of Air Distribution

With systems of air conditioning, the method of air distribution, as well as the practical details of design, are of utmost importance.

In an installation where exact relative humidity control is required, uniform temperature conditions are very important because a variation in relative humidity will be caused by any variation in temperature. Moreover, the air is usually admitted, especially in summer, at temperatures lower than that of the room in order to effect the necessary cooling. Therefore, the air must be distributed uniformly, not with respect to floor space but with respect to the amount of heat to be absorbed in the various portions of the room. Thus it is necessary for the air conditioning engineer to have exact information as to the distribution and sources of heat within the room, or else to have means of controlling the temperature or quantity of air supplied to the different sections independently.

A great deal of attention has been given to various methods of air distribution and for industrial work adjustable diffuser outlets have been developed which will spread the air uniformly in a fan-shaped manner. Such an outlet is also provided with a louvre damper to permit reduction of air velocity without changing distribution.

A second system of distribution utilizes a series of nozzles near the ceiling discharging horizontally at high velocity from one side of the room toward the other. The size of the nozzles used and their spacing depend upon the distance to which the air is to be carried. Such a system depends for its effect primarily upon the ejector action of a high velocity current of air which tends to produce a secondary current in the opposite

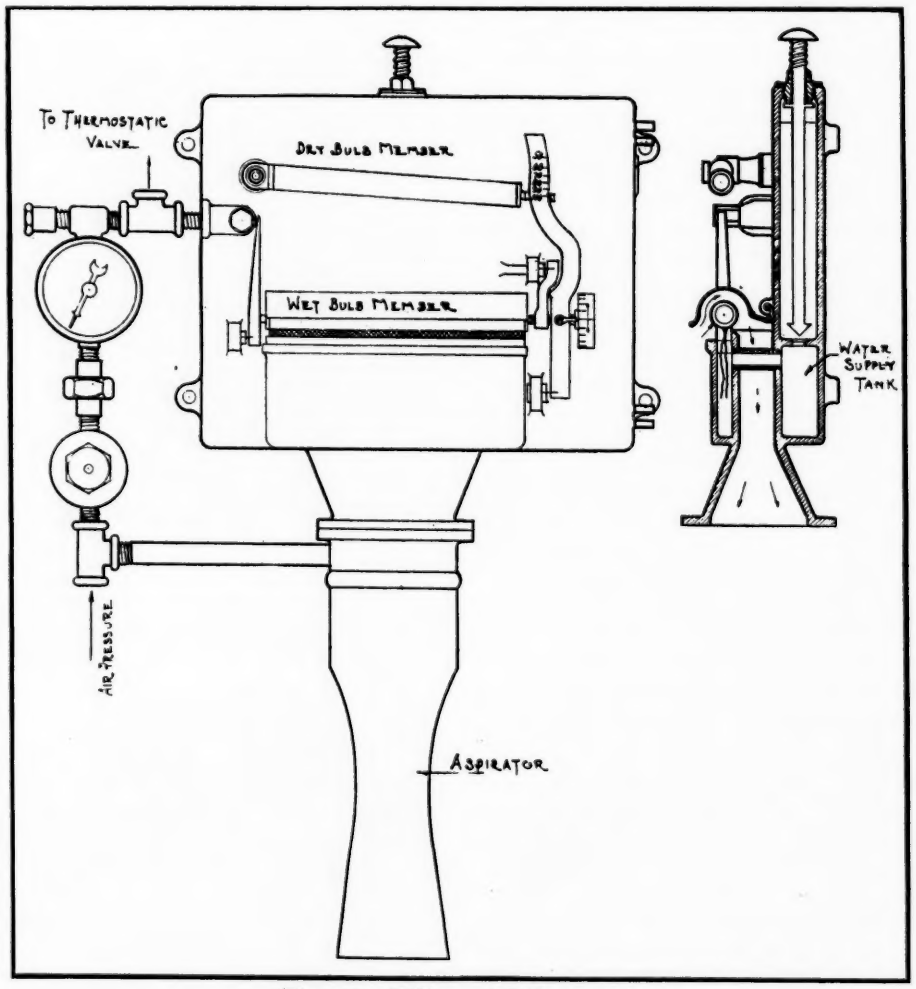


Fig. 11. Differential Hygrostat

direction over the area to be conditioned.

The volume of the secondary air current when set into motion is usually several times that of the primary air discharged, the ratio depending upon the velocity of the air leaving the nozzles. This system is termed the ejector system of air distribution and is particularly effective in securing a thorough air mixture and uniformity of temperature and humidity. It has been applied successfully to the cooling and air conditioning of auditoriums as well as to certain industrial problems, particularly those involving the drying and processing of materials.

A *third* system of distribution aims at producing the required results in an entirely different manner, and is known as the *pan system* of air distribution. In this system the air is distributed entirely from overhead, one outlet being provided uniformly for each unit of ceiling area.

The air is discharged downward against a flat plate and is thus diffused radially in all directions, laying a blanket of cool air which descends and mixes with the other air by gravity. This is to admit the air with the minimum effect of disturbance in the room itself and in installations for auditorium cooling it is effective in avoiding drafts. It is also very useful in certain industrial applications where cooling is required and it is desired not to disurb the heated areas, or to distribute dust or fumes throughout the building.

A *fourth* method, which was at one time most largely used, is that of distributing the air through mushroom outlets from the floor. In auditorium cooling, however, this has been objected to owing to the stratification of air and to the directing of cold air toward the feet and ankles of the occupants.

The indirect humidifiers and dehumidifiers just described are what are known as the central station type. That is, they consist of separate pieces of equipment, such as humidifiers, pumps, fans, distributing ducts, heaters, controls, etc., all assembled at the point of erection. They usually consist of but few sets of apparatus; more often only one set of equipment for the entire installation.

Unit Air Conditioners

There is now being introduced quite extensively what is known as the unit type of air conditioner. (Figs. 8 and 9) With this type of equipment the requirements of a given room are met by installing the necessary number of standard complete air conditioning units, usually without any distributing duct work, the necessary air distribution being accomplished by the location of the units themselves. Each unit is a complete air conditioning plant in itself including spray air conditioners (humidifier and dehumidifier) air re-heater, fan, spray pump, automatic control, etc. These are usually built in graduated standard sizes having capacities from 2,500 to 10,000 cu. ft. each.

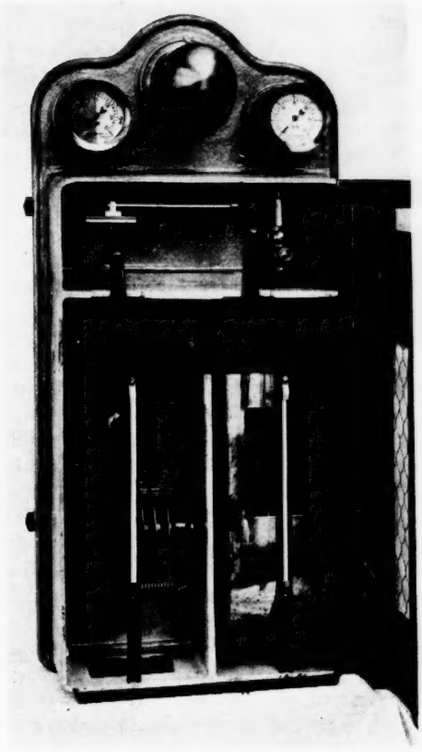


Fig. 12. A Common Form of Modern Hygrostat

There are several advantages of such equipment, as well as some disadvantages. The principal advantages are that the desirable results of the indirect humidification system can be applied to old buildings without installing duct work. Also, where manufacturing processes are changed and departments are subdivided or enlarged, the units are easily moved or increased in number to suit the new requirements. They are also particularly adapted for use by tenants of rented buildings since they are movable and do not become a part of the property when installed. Under certain conditions there is a more than sufficient saving by avoiding elaborate duct work to pay for the cost of the increased number of units. Standardized production and costs are also an added advantage.

On the other hand, air conditioning units, especially in manufactories where considerable dust and lint occur, require frequent attention and cleaning. Also some attention must be given the adjustment of controls. Such a multiple unit installation, therefore, often involves a great deal more attention than does a single unit located in the basement. In dehumidifying plants, especially, there is a great advantage in having a single air conditioning unit located conveniently to the refrigerating apparatus rather than to have a large number of water connections for supplies and returns. For dehumidification especially the central station system is to be recommended where more than three unit conditioners would be required.

Humidity Controlling Devices

Devices used in temperature control in air conditioning equipment are largely common forms which have long been in use and are well known. There are three general forms of these thermostats in use:

First, the most common, is the bimetal thermostat which operates on the principle of the differential expansion of two metals having different coefficients; these metals being brazed together in a curved strip. The result of a change of temperature is to cause a change in the curvature of this strip thus actuating a contact arm, or lever, a pneumatic valve or an electric contact which provides the motive power for the actual operation of the controlling valves or dampers. (Fig. 10)

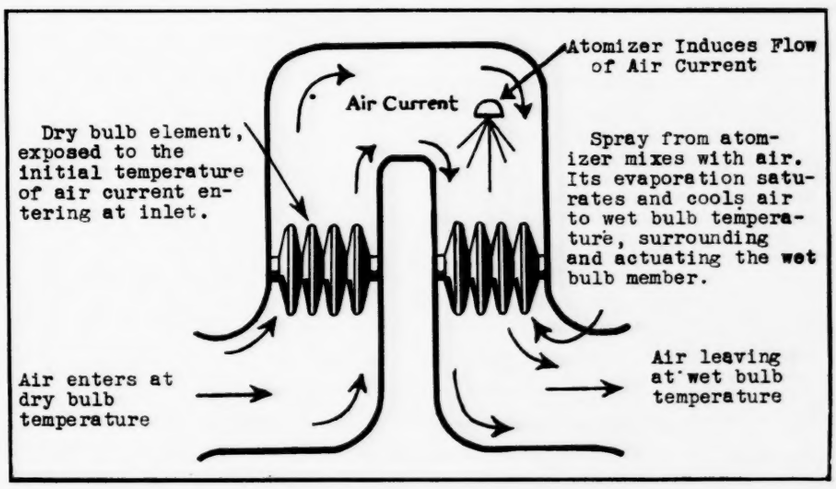

Atomizer Induces Flow of Air Current
Air Current
Dry bulb element, exposed to the initial temperature of air current entering at inlet.
Spray from atomizer mixes with air. Its evaporation saturates and cools air to wet bulb temperature, surrounding and actuating the wet bulb member.
Air leaving at wet bulb temperature
Air enters at dry bulb temperature

Fig. 13. Action of Hygrostat Shown in Fig. 12

The *second* type employs a metal diaphragm or bellows filled with a volatile liquid, the vapor pressure of which changes with change of temperature and actuates directly a pneumatic valve through which it controls the governing valves or dampers in the air conditioning apparatus.

The *third* type of thermostat is the duct thermostat in which the sensitive element is inserted in the duct, while the setting dial and air pressure connections are on the outside. This type of thermostat consists of an outside tubular thermo-responsive casing of brass or aluminum, or other highly thermo-responsive metal, and an inner rod or tube of special nickel steel or other metal, which is relatively unaffected by temperature changes. The valve is carried directly upon the inside non-expansive element. The outer expansion element and the inner element carries the pneumatic valve which operates directly upon an adjustable seat connected to the expansive element. This is also provided with a constant leak. The action of this air supply valve in connection with the constant leak is such as to increase or decrease the pressure upon the operating diaphragms of the valve, or damper air motors. This type of thermostat is very rugged and responds to slight temperature changes with proportionate graduated effect.

Hygrostats are of two general types. The *first* type is in effect a form of differential thermostat in which one expansive element is affected by the wet-bulb temperature, which temperature is suitably maintained either by a wick or a spray of water. These thermostatic elements are so inter-connected that they will not be affected by changes of temperature alone, but only by changes in the relation between the wet and dry-bulb temperature which would result in changing the relative humidity. Such a correlation is made possible by the fact that there is practically a straight line relationship between the relative temperature changes of wet and dry bulb for any definite relative humidity (Fig. 11). As in the thermostat, these elements may be either of the solid expansion or vapor pressure type. A common form of this apparatus is shown in Figs. 12 and 13.

The *second* form of hygrostat is that depending upon the dimensional changes of hygroscopic materials due to changes in moisture content. In these instruments the humidity responsive element works directly upon pneumatic valves or electric contacts. The sensitive element responds to relative humidity and affects the actuating mechanism precisely as the thermostat responds to temperature.

It is found that suitable hygrostatic materials show no material change in extension with changes of temperature so long as the relative humidity is constant, although the actual moisture content of the hygroscopic material itself undergoes slight changes under these conditions.

Temperature and humidity-controlling devices usually act upon the large control valves or dampers in the air conditioning apparatus through the medium of compressed air or electric currents. In either case the actuation is accomplished by suitable motors, either pneumatic or electric. For all the larger installations the pneumatic control is practically universally used on account of simplicity, reliability, and also on account of the fact that it permits graduation of dampers or valves with temperature or humidity changes.

In the smaller humidifying devices electric controls are very serviceable because of simplicity of the circuits and from the fact that there are no auxiliaries, such as air compressors, air tanks, air filters, relief valves, etc., required. In the larger systems such accessories are warranted by the increased size of equipment and the increased number of controls operated from the same compressed air source.

In the unit types of equipment, direct acting thermostats and hygrostats are sometimes used in which the responsive element works directly upon the valves controlled without the intermediary use of either compressed air or electric current. Such applications are illustrated for thermostats in Fig. 14, and for hygrostats in Fig. 5.

Modern air conditioning provides many devices for increasing or decreasing relative humidity within an enclosure. It also provides automatic means for the control of both temperature and humidity at any desired point regardless of external weather conditions and regardless of the effects of occupancy, or of manufacturing processes. It has resulted not only in great economic savings in many industries but has permitted standardizations of manufacturing which were heretofore impossible owing to variations in weather conditions.

It has in many instances greatly improved the quality and uniformity of the product. Moreover, it has much improved working conditions in many industries and added greatly to the efficiency of the workers. It has afforded conditions of maximum comfort in crowded theatres and auditoriums during the hot summer months as well as in the winter, thus greatly increasing the return from the investment in such properties. In short, air conditioning has contributed both to the wealth and personal comfort of human society.

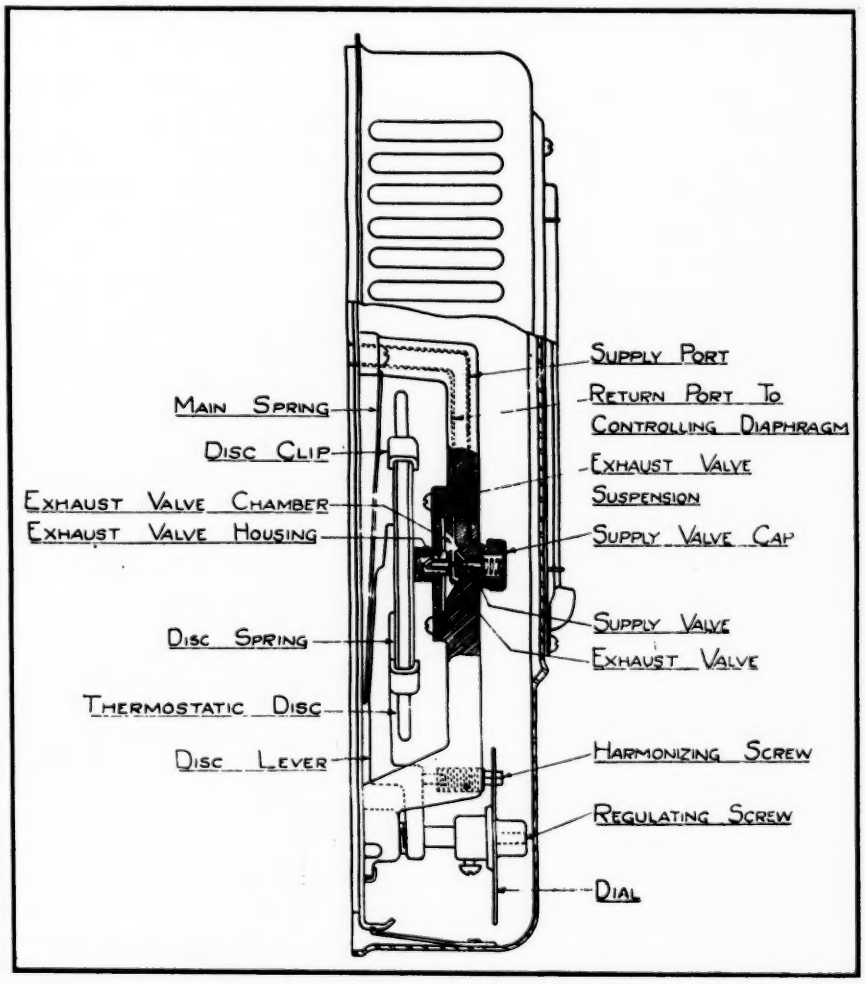


Fig. 14. Application of Thermostat

Boilers, Furnaces and Radiators Included in List of Approved Gas-Fired House-Heating Appliances

GAS-FIRED house-heating boilers, warm-air furnaces and radiators which have passed the requirements of the American Gas Association Testing Laboratory are included in the following list.

This list, corrected up to February 1, 1930, does not include radiant heaters, fireplaces, or other space heaters, except the gas-fired radiators.

Tests specified by the requirements of the laboratory may be divided into two general classes, construction and performance. While most of the construction tests have at least an indirect bearing on safety, in many instances they also set minimum weights of material permissible, and by virtue of this fact, insure reasonable durability. So far as the customer is concerned, the performance tests insure the following, provided the appliance is properly installed and intelligently used: A satisfactory operating efficiency and safety from leakage of raw gas, from explosion, from fire hazard and from incomplete combustion, and many other essential safety features.

Consequently, the Laboratory Approval Seal, when affixed to a gas appliance, is therefore a guarantee of compliance with basic national requirements for safety.

The requirements are drawn up by a committee which represents the American Gas Association, U. S. Bureau of Standards, U. S. Bureau of Mines, U. S. Public Health Service, National Association of Heating and Piping Contractors, Master Plumbers' Association, The Canadian Gas Association and other interested national elements.

The only measured gas-fired heating appliance not included in this list is the gas-fired unit heater, for which, at the present time, no approval requirements exist. Such requirements, however, are at present being drawn up and will probably be announced in the near future.

BOILERS

American Radiator Co.,
40 W. 40th St., New York, N. Y.

Number	Output Rating Sq. Ft. Steam Radiation	Output Rating Sq. Ft. Water Radiation
Trade Name—Arcola		
G A 4	270	430
G A 5	340	540
G A 6	410	660
G A 7	480	770
Trade Name—Ideal		
O-GS-4, O-GW-4	270	430
O-GS-5, O-GW-5	340	540
O-GS-6, O-GW-6	410	660
O-GS-7, O-GW-7	480	770
1-GS-4, 1-GW-4	550	880
1-GS-5, 1-GW-5	710	1,130
1-GS-6, 1-GW-6	870	1,390
1-GS-7, 1-GW-7	1,030	1,640
1-GS-8, 1-GW-8	1,180	1,890
1-GS-9, 1-GW-9	1,340	2,150
1-GS-10, 1-GW-10	1,500	2,400
1-GS-11, 1-GW-11	1,660	2,650
4-GS-6, 4-GW-6	2,000	3,200
4-GS-7, 4-GW-7	2,400	3,840
4-GS-8, 4-GW-8	2,800	4,480
4-GS-9, 4-GW-9	3,200	5,120
4-GS-10, 4-GW-10	3,600	5,760
4-GS-11, 4-GW-11	4,000	6,400
4-GS-13, 4-GW-13	4,800	7,680
4-GS-15, 4-GW-15	5,600	8,960
4-GS-17, 4-GW-17	6,400	10,240
4-GS-19, 4-GW-19	7,200	11,520
4-GS-21, 4-GW-21	8,000	12,800
4-GS-22, 4-GW-22	8,400	13,440
4-GS-25, 4-GW-25	9,600	15,360
4-GS-28, 4-GW-28	10,800	17,280

Bastian-Morley Co., La Porte, Ind.

Number	Output Rating Sq. Ft. Steam Radiation	Output Rating Sq. Ft. Water Radiation
Trade Name—Basmor		
4-A-3	470	750
4-A-4	690	1,100
4-A-5	900	1,440
4-A-6	1,100	1,770
4-A-7	1,300	2,080
4-A-8	1,520	2,430
4-A-9	1,730	2,770
4-A-10	1,950	3,120
4-A-11	2,170	3,470
4-A-12	2,380	3,810
4-A-13	2,600	4,160
4-A-14	2,820	4,510
4-A-15	3,040	4,850
4-A-16	3,250	5,200
4-A-17	3,470	5,550
4-A-18	3,680	5,900
4-A-19	3,900	6,240
4-A-20	4,120	6,590
4-A-21	4,340	6,930
4-A-22	4,550	7,280
4-A-23	4,770	7,630
4-A-24	4,990	7,970
4-A-25	5,200	8,320
4-A-26	5,410	8,670
4-A-27	5,630	9,010
4-A-28	5,850	9,360
4-A-29	6,070	9,710
4-A-30	6,280	10,060
4-A-31	6,500	10,400
4-A-32	6,710	10,750
4-A-33	6,930	11,100
4-A-34	7,150	11,440
4-A-35	7,360	11,790

B-Line Boiler Co., E. 131st St., Cleveland, O.

Number	Output Rating Sq. Ft. Steam Radiation	Output Rating Sq. Ft. Water Radiation
Trade Name—B-Line		
32	410	650
43	610	980
54	820	1,300
65	1,020	1,630
76	1,220	1,960
87	1,430	2,280
98	1,630	2,610
109	1,840	2,940
1110	2,040	3,260
1211	2,240	3,590
1312	2,450	3,910
1413	2,650	4,240
1514	2,860	4,570
1615	3,060	4,890
1716	3,280	5,220
1918	3,670	5,870
2019	3,880	6,200
2120	4,080	6,520
2322	4,490	7,180
2524	4,900	7,830
2726	5,300	8,480
2928	5,710	9,130
3130	6,120	9,790
3332	6,530	10,440
3534	6,940	11,090
3736	7,340	11,740
3938	7,750	12,400
4140	8,160	13,050
4544	8,980	14,360

Bryan Steam Corp., Peru, Ind.

Number	Output Rating Sq. Ft. Steam Radiation	Output Rating Sq. Ft. Water Radiation
Trade Name—Bryan		
8	830	1,330
10	1,200	1,920

Bryant Heater & Mfg. Co.,
17825 St. Clair Ave., Cleveland, O.

Number	Output Rating Sq. Ft. Steam Radiation	Output Rating Sq. Ft. Water Radiation
Trade Name—Bryant		
3-S2	220	350
4-S2	290	470
5-S2	370	590
6-S2	440	700
7-S2	510	820
3-S4	450	720
4-S4	600	960
5-S4	750	1,200
6-S4	900	1,440
7-S4	1,050	1,680
8-S4	1,200	1,920
9-S4	1,350	2,160
11-S4	1,650	2,640
13-S4	1,950	3,120
15-S4	2,250	3,600
17-S4	2,550	4,080
19-S4	2,850	4,560
21-S4	3,150	5,040
23-S4	3,450	5,520
25-S4	3,750	6,000
27-S4	4,050	6,480
29-S4	4,350	6,960
31-S4	4,650	7,440
35-S4	5,250	8,400
37-S4	5,550	8,880
39-S4	5,850	9,360
Models 43 and 45		
3	560	890
4	740	1,190
5	930	1,480
6	1,110	1,780
7	1,300	2,070
8	1,480	2,370
9	1,670	2,660
10	1,850	2,960
11	2,040	3,260
12	2,220	3,550
13	2,410	3,850
Model 6		
6	2,220	3,550
8	2,960	4,740
10	3,700	5,920
12	4,440	7,100
14	5,180	8,290
16	5,920	9,470
18	6,660	10,660
22	8,140	13,020
26	9,620	15,390

L. J. Mueller Furnace Co., 167 Reed St., Milwaukee, Wis.

Number	Output Rating Sq. Ft. Steam Radiation	Sq. Ft. Water Radiation
Trade Name—Gas Era		
13	420	670
25	840	1,340
37	1,260	2,010
49	1,680	2,680
511	2,100	3,350
613	2,520	4,020
715	2,940	4,690
817	3,360	5,360
919	3,780	6,030
1021	4,200	6,700
1123	4,620	7,370
1225	5,040	8,040
1327	5,460	8,710
1429	5,880	9,380
1531	6,300	10,050
1634	6,720	10,720
1838	7,560	12,060
2042	8,400	13,400
2246	9,240	14,740
2450	10,080	16,080
2654	10,920	17,420
2858	11,760	18,760
3062	12,600	20,100

National Radiator Corp., Johnstown, Pa.

Trade Name—National		
1	320	510

Peerless Heater Co., Boyertown, Pa.

Trade Name—Peerless		
7	820	1,310
8	930	1,490
9	1,050	1,680
10	1,170	1,870
11	1,280	2,050
12	1,400	2,240
13	1,520	2,430
14	1,630	2,610
16	1,870	2,990
18	2,100	3,360
20	2,330	3,730

Pittsburg Water Heater Co., Carnegie, Pa.

Trade Name—Pittsburgh		
30-S	750	1,200
40-S	1,000	1,600
50-S	1,250	2,000
60-S	1,500	2,400
70-S	1,750	2,800
80-S	2,000	3,200
441-S	2,250	3,600
451-S	2,500	4,000
551-S	2,750	4,400
561-S	3,000	4,800
661-S	3,250	5,200
671-S	3,500	5,600
771-S	3,750	6,000
781-S	4,000	6,400

Richmond Radiator Company,
2220 Chestnut St., Philadelphia, Pa.

Trade Name—Richmond Heatomat		
14	350	560
15	440	700
16	530	840
17	610	980
18	700	1,120
25	870	1,400
26	1,050	1,680
27	1,230	1,960
28	1,400	2,240
36	1,580	2,520
37	1,840	2,940
38	2,100	3,360
47	2,450	3,920
48	2,800	4,480
57	3,070	4,910
58	3,500	5,600
68	4,200	6,720
78	4,900	7,840
88	5,600	8,960
98	6,300	10,080
108	7,000	11,200
118	7,700	12,320
128	8,400	13,440

FURNACES

Frank Z. Ahl Sheet Metal Works,
1615 21st St., Sacramento, Calif.

Number	Input Rating B.T.U. per hr.
Trade Name—Ahl	
325 A	44,000
431 A	66,000
535 A	82,500

American Foundry & Furnace Co.,
Bloomington, Ill.

Trade Name—Solar Heat Generator	
58	795,000

Anderson Gas Appliance Co.,
711 Vancouver Ave., Portland, Ore.

Trade Name—Sav-Yur Gas	
44S	70,000

Andrews-Schroeder Heating Co., Inc.,
1911 Fourth Ave., Los Angeles, Calif.

Number	Input Rating B.T.U. per hr.
Trade Name—Andrews-Schroeder	
2	39,750
3	52,125
4	66,500

Atlas Heating & Ventilating Co., Inc.,
557 4th St., San Francisco, Calif.

Trade Name—Atco	
2 A	65,000
3 A	85,000

Arthur Betz, 789 Broadway, Pasadena, Calif.

Trade Name—Betz	
4	55,000
6	87,000

California Furnace Manufacturers Exchange,
350 S. Raymond Ave., Pasadena, Calif.

Trade Name—Calfur	
35.5 M	35,500
50.0 M	50,000
71.0 M	71,000
106.5 M	106,500
142.0 M	142,000

Carrier-Lyle Corporation,
850 Frelinghuysen Ave., Newark, N. J.

Trade Name—Weathermaker	
1	88,000
2	175,000
3	250,000

Cass Manufacturing Co.,
208 S. Spring St., Los Angeles, Calif.

Trade Name—Cass	
1	40,000
2	80,000
3	120,000

Columbus Heating & Ventilating Co.,
425 W. Town St., Columbus, O.

Trade Name—Columbus	
615	85,000
815	128,400
915	171,200
917	214,000
1015	256,800
1115	342,400
1215	428,000

Electrogas Furnace Co.,
Rialto Bldg., San Francisco, Calif.

Trade Name—Electrogas	
1	20,000

R. E. Fraser Company,
445 S. San Joaquin St., Stockton, Calif.

Trade Name—Fraser	
120	22,500
130	41,250

L. H. Freymuth, Jr.,
317 E. Pico St., Los Angeles, Calif.

Trade Name—Perfection	
1	32,500
2	65,000
3	97,500

Golden Gate Sheet Metal Works,
1515 14th Ave., Oakland, Calif.

Trade Name—Golden Gate	
A	50,000

Ke-Ro-Co Heater Co.,
132 14th St., Oakland, Calif.

Trade Name—Ke-Ro-Co	
A 11-K	15,000
A 22-K	22,000
A 33-K	35,000

Magic Way Co., National City, Calif.

Trade Name—Magic Way	
3	30,250
4	45,000
5	60,000

McLaughlin Sheet Metal Works,
1912 Eye St., Sacramento, Calif.

Trade Name—McLaughlin	
300	49,500
500	82,500
700	105,000
800	135,300

Meyers Fuel Saver Co.,
151 South River St., Janesville, Wisc.

Trade Name—Meyers Fuel Saver	
	150,000

Miller Furnace Co.,
2165 39th Ave., Oakland, Calif.

Trade Name—Miller	
3, 4	18,425

L. J. Mueller Furnace Co.,
167 Reed St., Milwaukee, Wis.

Number	Input Rating B.T.U. per hr.
Trade Name—Gas Era	
1	65,000
2	130,000
3	195,000
4	260,000
5	325,000
6	390,000

Murphy Sheet Metal Works,
718 Sixth St., San Pedro, Calif.

Trade Name—Murphy	
2	40,000

Pacific Gas Appliance Co.,
19th & Market Sts., Oakland, Calif.

Trade Name—Harris	
1, 100	27,000
2, 200	50,000
3, 300	66,000
1	17,500
Junior	17,500

Pacific Gas Heating Co.,
424 Sutter St., San Francisco, Calif.

Trade Name—Mars	
400	70,000

Pacific Gas Radiator Co.,
7541 Roseberry St., Huntington Park, Calif.

Trade Name—Pacific	
1	40,000
2	53,000
3	70,000
4	100,000
6	200,000
8	290,000
10	380,000
02	28,600

American Heating Co., Inc.,
620 N. Lake St., Pasadena, Calif.

Trade Name—Ohrmund	
167	48,500
241	70,000

Payne Furnace and Supply Co.,
338 N. Foothill Rd., Beverly Hills, Calif.

Trade Name—Payne	
A-1	22,500
A-2	45,000
A-3, 300	67,500
A-4, 400	90,000
A-5	112,500
A-6	135,000
A-8, 800	152,000
A-12 1200	228,000
A-16	304,000
A-20	380,000
11	15,000
22	22,000
33	35,000

Pennsylvania Furnace & Iron Co.,
313 Pine St., Warren, Pa.

Trade Name—Pennsylvania	
16	94,500
20	112,500
24	150,000
28	187,000
32	225,000

Phillips Heating, Ventilating & Mfg. Co.,
1710 W. Washington St., Los Angeles, Calif.

Trade Name—Martin	
2 A	42,000
3 A	60,000
4 A	85,000
5 A	110,000

Progressive Foundry Works Inc.,
10 Mt. Road Blvd., Rochester, N. Y.

Trade Name—Rochester	
6	81,000

A. H. Robinson Co., Massillon, Ohio

Trade Name—Robinson	
	100,000

Geo. D. Roper Corp., Rockford, Ill.

Trade Name—Roper	
4001	75,000
4002	150,000
4003	225,000
4004	300,000
4005	375,000
4006	450,000

Rudy Furnace Co., Dowagiac, Mich.

Trade Name—Bon Air	
	75,000
	225,000

J. B. Smith Heating Co., Inc.,
5426 Santa Monica Blvd., Hollywood, Calif.

Number	B.T.U. per hr. Input Rating
Trade Name—Smith	
A 1	37,500
A 2	50,000
A 3	75,000
A 4	100,000

Texo Heater & Mfg. Corp.,
220 Madison Ave., Covington, Ky.

Trade Name—Sunnyaire	
3	125,000

Ward Heater Company,
1243 S. Hope St., Los Angeles, Calif.

Trade Name—Ward	
1	18,000
2	25,000
4	30,000

Wise Furnace Co.,
100 Lincoln St., Akron, Ohio

Trade Name—Wise	
3	66,700
4	100,000
20	90,000

SPACE HEATERS

American Gas Products Corp.,
376 Lafayette St., New York

Trade Name—A.G.P. Warm-Air Radiator
Type—Unvented

4 Sec. 33 In.	8 Sec. 33 In.
6 Sec. 33 In.	10 Sec. 33 In.

Trade Name—A.G.P. Corto Gas Steam Radiator
Type—Unvented, 5-column

4 Sec. 26 In.	4 Sec. 32 In.	4 Sec. 38 In.
6 Sec. 26 In.	6 Sec. 32 In.	6 Sec. 38 In.
8 Sec. 26 In.	8 Sec. 32 In.	8 Sec. 38 In.
10 Sec. 26 In.	10 Sec. 32 In.	10 Sec. 38 In.
12 Sec. 26 In.	12 Sec. 32 In.	12 Sec. 38 In.
15 Sec. 26 In.	15 Sec. 32 In.	15 Sec. 38 In.

Automatic Gas Steam Radiator Co.,
301 Brushton Ave., E. Pittsburgh, Pa.

Trade Name—Elite
Type—Unvented, 5-column

4 Sec. 22 In.	4 Sec. 27 In.	4 Sec. 38 In.
6 Sec. 22 In.	6 Sec. 27 In.	6 Sec. 38 In.
8 Sec. 22 In.	8 Sec. 27 In.	8 Sec. 38 In.
10 Sec. 22 In.	10 Sec. 27 In.	10 Sec. 38 In.
12 Sec. 22 In.	12 Sec. 27 In.	12 Sec. 38 In.
15 Sec. 22 In.	15 Sec. 27 In.	15 Sec. 38 In.

Type—Unvented, 7-column
10 Sec. 32 In.

Trade Name—Pittsburgh
Type—Vented, 5-column

4 Sec. 27 In.	4 Sec. 38 In.
6 Sec. 27 In.	6 Sec. 38 In.
8 Sec. 27 In.	8 Sec. 38 In.
10 Sec. 27 In.	10 Sec. 38 In.
12 Sec. 27 In.	12 Sec. 38 In.
15 Sec. 27 In.	15 Sec. 38 In.

James B. Clow & Sons,
201 N. Talman Ave., Chicago, Ill.

Trade Name—Clow Gas Steam Radiator
Type—Unvented, 4-tube

4 Sec. 22 In.	4 Sec. 26 In.	4 Sec. 38 In.
6 Sec. 22 In.	6 Sec. 26 In.	6 Sec. 38 In.
8 Sec. 22 In.	8 Sec. 26 In.	8 Sec. 38 In.
10 Sec. 22 In.	10 Sec. 26 In.	10 Sec. 38 In.
12 Sec. 22 In.	12 Sec. 26 In.	12 Sec. 38 In.
15 Sec. 22 In.	15 Sec. 26 In.	15 Sec. 38 In.

Type—Vented, 4-tube

5 Sec. 38 In.	15 Sec. 38 In.	9 Sec. 26 In.
7 Sec. 38 In.	20 Sec. 38 In.	11 Sec. 26 In.
9 Sec. 38 In.	25 Sec. 38 In.	13 Sec. 26 In.
11 Sec. 38 In.	5 Sec. 26 In.	15 Sec. 26 In.
13 Sec. 38 In.	7 Sec. 26 In.	20 Sec. 26 In.
		25 Sec. 26 In.

Type—Unvented, 6-tube
2 Sec. 22 In., 26 In. and 31 In.
3 Sec. 22 In., 26 In. and 31 In.
4 Sec. 22 In., 26 In. and 31 In.
5 Sec. 22 In., 26 In. and 31 In.
6 Sec. 22 In., 26 In. and 31 In.
7 Sec. 22 In., 26 In. and 31 In.
8 Sec. 22 In., 26 In. and 31 In.
9 Sec. 22 In., 26 In. and 31 In.
10 Sec. 22 In., 26 In. and 31 In.

Hammel Radiator Corp.,
715 S. Figueroa St., Los Angeles, Calif.

Trade Name—Hammel
Type—Unvented, 5-column

8 Sec. 26 In.	10 Sec. 26 In.
8 Sec. 32 In.	10 Sec. 32 In.

Hugo Manufacturing Co.,
West Duluth, Minn.

Trade Name—Hawks
Type—Vented

Number		Number	B.T.U. per hr. Input Rating
780	4 Sec.	782	5 Sec.
780	6 Sec.	782	7 Sec.
780	8 Sec.	782	9 Sec.
780	10 Sec.	782	11 Sec.
782	15 Sec.	782	13 Sec.
		782	17 Sec.

Type—Unvented

781	4 Sec.
781	6 Sec.
781	8 Sec.
781	10 Sec.

Pacific Gas Radiator Co.,
7541 Roseberry St., Huntington Park, Calif.

Trade Name—Forcol
Type—Unvented, 4-column

4 Sec. 38 In.
5 Sec. 38 In.
6 Sec. 38 In.
8 Sec. 38 In.
10 Sec. 38 In.
12 Sec. 38 In.
15 Sec. 38 In.

Type—Unvented, 5-column

4 Sec. 32 In.	4 Sec. 26 In.
5 Sec. 32 In.	5 Sec. 26 In.
6 Sec. 32 In.	6 Sec. 26 In.
8 Sec. 32 In.	8 Sec. 26 In.
10 Sec. 32 In.	10 Sec. 26 In.
12 Sec. 32 In.	12 Sec. 26 In.
15 Sec. 32 In.	15 Sec. 26 In.

Roberts-Gordon Appliance Corp.,
309 Curtiss Bldg., Buffalo, N. Y.

Trade Name—Duplex
Duplex Heating System

J. B. Slattery & Bro., Inc.,
171 Wallabout St., Brooklyn, N. Y.

Trade Name—Economic Gas Steam Radiator
Type—Unvented, 6-column

4 Sec. 38 In.	4 Sec. 32 In.	4 Sec. 26 In.
6 Sec. 38 In.	6 Sec. 32 In.	6 Sec. 26 In.
8 Sec. 38 In.	8 Sec. 32 In.	8 Sec. 26 In.
10 Sec. 38 In.	10 Sec. 32 In.	10 Sec. 26 In.
12 Sec. 38 In.	12 Sec. 32 In.	12 Sec. 26 In.
15 Sec. 38 In.	15 Sec. 32 In.	15 Sec. 26 In.

Superior Gas Steam Radiator Co.,
113 S. La Brea Ave., Los Angeles, Calif.

Trade Name—Superior
Type—Unvented, 5-column

4 Sec. 32 In.	4 Sec. 26 In.
5 Sec. 32 In.	5 Sec. 26 In.
6 Sec. 32 In.	6 Sec. 26 In.
8 Sec. 32 In.	8 Sec. 26 In.
10 Sec. 32 In.	10 Sec. 26 In.
12 Sec. 32 In.	12 Sec. 26 In.
15 Sec. 32 In.	15 Sec. 26 In.

Purdue to Hold Short Course in Gas House-Heating

Tentative plans have been announced by Prof. R. B. Leckie, professor of gas engineering at Purdue University, for a short course in gas house-heating to be held at Purdue the latter part of April.

At a meeting of a committee of the Indiana Gas Association the plans were outlined and will be presented to the directors of the association at their next meeting.

The course will probably be of three days' duration, and will be confined to the heating of homes with gas. It will be sponsored by the gas engineering department of the school of chemical engineering and the engineering extension department of Purdue University, in cooperation with the Indiana Gas Association. In the plan outlined for the course, types of gas heating units for homes, building construction, insulation and other subjects are to be included.

Air Conditioning System Being Installed in the White House

Presidents will work in year-round comfort, hereafter, whatever may be the weather in Washington. An air-conditioning system is being installed, in the restoration of the interior of the White House executive office building, after the recent fire, which will manufacture weather of the right temperature and relative humidity.

This system's more spectacular service will be to keep the building cool during the eight hot months of the Washington year, but its function in winter will be no less important, for it will protect the occupants from the effects of improper ventilation and overheated dry air, which medical authorities now recognize as the cause of much winter illness. The windows will be kept closed the year round, thus excluding noise and dust, yet the manufactured weather inside will be maintained by automatic thermostats and humidity regulators with a relative humidity around 50%, which is ideal. Not all of the president's staff will want exactly the same degree of warmth, but that can be controlled in each office.

The decision to put air conditioning in the executive offices had been made before the fire.

Outdoor air will be brought through an intake under the back stoop of the building, drawn through a filter which will remove dust, soot and germs, then blown through a chamber filled with atomized water. This washes out the last of the foreign matter and, through control of the temperature of the water, adds humidity when the heated air would be too dry in winter or precipitates out excess moisture when it is too humid for comfort in summer. To chill this spray water when humidity must be taken out of the air, a centrifugal refrigerating unit supplying the equivalent of 30 tons of ice melting each 24 hrs. (enough to put 25 lbs. of ice a day in the refrigerators of 2400 families) will be installed in a small room excavated under the front steps of the building. The rest of the air-conditioning apparatus, surprisingly compact for its capacity, goes into one corner of the existing basement. There will be no exposed pipes or ducts upstairs, the air coming in near the ceilings of the offices through openings concealed by ornamental plaques that blend into the decorations and being exhausted through inconspicuous grilles near the floor level. The whole system is being soundproofed so that there will be no mechanical noise from it audible in the offices, and so that the air ducts will not transmit sound from office to office.

Correspondence

Water Leaving the Boiler

EDITOR HEATING AND VENTILATING:

In a steam-heating plant in a theater, when the boiler is fired to 1½ lb. of steam, water leaves by way of return to radiators, resulting in no heat.

The boiler is in the basement with a 3-in. steam main running from the header on the boiler up about 2 ft., pitches down 2 in. in 12 ft., from which a 1¼ in. bleeder runs down. The 3-in. main goes directly to the attic, pitches down to the front of the building about 1 in. to 10 ft.

Seven radiators are taken from the main on one side, and 7 on the other, with about 1200 sq. ft. of radiation connected. The returns to the boiler are carried under the floors in cement and are of 1¼ in. diameter on each side of the room. The return drops from the front radiator back to the boiler room, a distance of 75 ft., with a drop of 4 ft. toward the boiler.

After entering the boiler room the return is 24 in. from the water line to the return pipes. The return on the right side is close to the boiler, while the one on the left drops to a wet return and back to the boiler, the wet return being about 40 ft. in length. The steam main in the attic, which is 15 ft. above the radiator branch down to each radiator, contains a tee for each down feeder. The lowest radiator is 28 in. above the water line in the boiler. The system is a low-pressure steam, with 1¼-in. valves on each radiator.

Please advise what is the trouble.

E. M. C.

Macomb, Ill.

The cause of the trouble in the heating installation in the theater is due to the dry return and the unsealed connections of the intermediate drop risers.

Referring to Fig. 1 it will be noted that steam enters the dry return along with the water of condensation through every intermediate drop riser. It does so at the point marked B, and also at A. However, the steam entering at B has a shorter distance to travel, resulting in less friction loss, has a greater pressure than that entering the return at A and consequently forces this condensation back to and past such points as A and water seals the lower radiators.

It is this trapped water that causes the noise, and its detention in the return pipes lowers the water level in the boiler, so that the water returns only when the boiler cools off. The same condition exists between the points A and B and anywhere else where the intermediate drop risers enter the dry return unsealed.

The correction would be to drop the dry return and make it entirely wet when each intermediate riser can be dropped into it. It is well to have a small horizontal set-off in these drops just under the lower radiator so as to have a good vent location. This is shown in Fig. 2.

If the conditions prevent the use of a wet return, it can still be left dry but the intermediate risers must be trapped before connecting to it, or the connections made through a water seal as shown in Fig. 3. In case a dry return is used, it should be kept as high above the water line of the boiler as possible.

It would be better if there were a greater height than 28 in. between the boiler water line and the lower radiators. A large friction loss in the steam flow always demands a large water head. Sufficient data were not given on the length of the runs of piping so that we could determine the length, but from the pipe sizes given and estimating the length, the 28 in. head should be sufficient.

Cracked Boiler Sections

EDITOR HEATING AND VENTILATING:

In a hot water installation an intermediate section of the round boiler cracked sometime ago, following which a new section was installed. This also cracked and a third new one also has failed. The system is an open tank job, and the expansion line was not frozen. The feed water valve was tight and the water supply pressure was normal—70 lb. No repairs were made before the three cracks. A total of 610 sq. ft. of direct radiation is installed and the boiler is a 25-in. 6 section, round boiler. what is the trouble?

C. W. R.

Cresson, Pa.

Breaks of this nature are many times caused by too great a pressure in the boiler, due to the static height of the system being higher than the boiler can stand. While this height was not stated in the question, it may not be the cause of the trouble, since the new section is always the one that breaks, instead of the older, weakened ones. The trouble is probably due to a second cause. After a boiler has been in use, soot deposits find their way into the crevices between these sections and become extremely hard. This forces an unequal setting and results in a cracked setting. When a new section is inserted, if the soot is not thoroughly filed away the same accident will probably happen repeatedly.

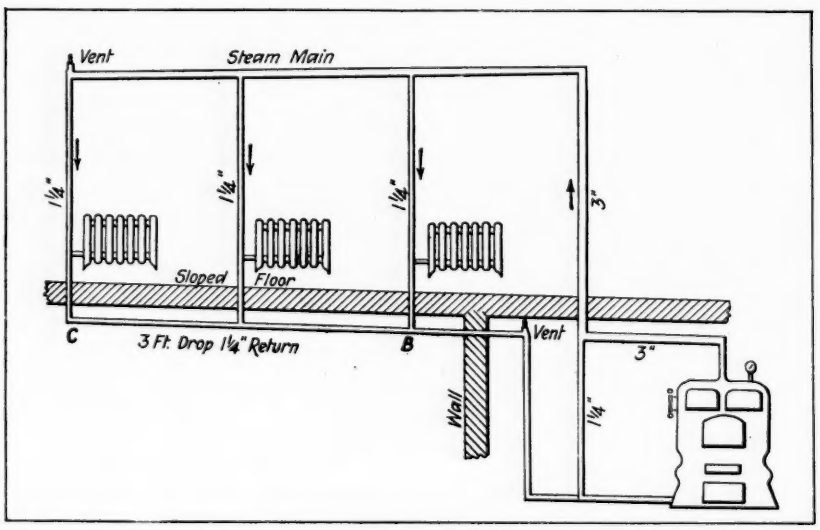
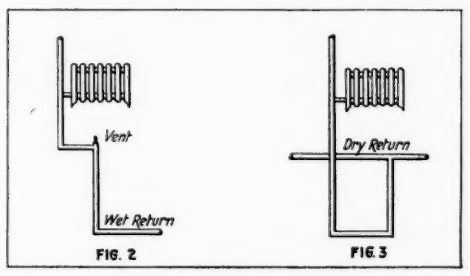


Fig. 1. Layout of System in which Water Leaves the Boiler



Figs. 2 and 3. Alternative Methods of Connecting Return Risers to Return Main

Relative Efficiencies of Gas and Coal Heaters

EDITOR HEATING AND VENTILATING:

In giving the degree-days for December in the various cities, your footnote gives the corresponding coal, gas and oil consumption per square foot of radiation. Checking back, I note that the ratio of coal to gas is 24,000 cu. ft. of gas per ton of coal. This is correct assuming an equal efficiency for both.

In actual practice, I believe that we may assume that an average coal-fired heating plant runs about 40% efficiency. Probably the average efficiency of a gas plant should be about 60% efficiency, so this makes a difference.

I have also found, from taking an average of bills here, that one ton of coal will handle about 30 sq. ft. of radiation per season. Also a fair gas allowance would be 450 to 500 cu. ft. of gas per square foot of steam radiation per season. Combining the above, it makes about thirty times 450 or 500 cu. ft., or 13,500 to 15,000 cu. ft. of gas per sq. ft. However, it is probable that they may run higher than this, but certainly not as high as 24,000. This last figure is one that can be used when comparing gas to the highest type of stoker-fired coal-burning plant of very high efficiency.

W. D. E.

Memphis, Tenn.

In the degree-day data published each month in HEATING AND VENTILATING 100% efficiency is assumed for all fuels. The published figures must be corrected for the known or assumed efficiency of the system in question.

National District Heating Association

Alex. Dow Honored by N. D. H. A.

Alex. Dow, president of the Detroit Edison Company, recently received the election of honorary membership in the National District Heating Association at a dinner given for him by the executive committee of the association at the Detroit Athletic Club.

Past President John W. Meyer acted as toastmaster and gave a summary of the progress of district heating throughout the United States, and credited the Detroit Edison Company, under the leadership of Mr. Dow, with having done more than any other company to advance the cause of district heating.

The president of the association, J. C. Butler, followed with a talk on the present status of the association, laying out its far reaching aims and hopes and paying testimony to the able service of Mr. Dow.

D. L. Gaskill, secretary of the association, told of the many interesting incidents in connection with district heating which he has encountered during the past 20 years. He then presented to Mr. Dow the certificate of honorary membership in the association.

In his response, Mr. Dow covered practically the entire utility field and closed his remarks with the hope that district heating will continue to expand and grow in its importance and demand.

One of the features of the meeting was the entertainment extended by the Detroit Edison Company. The visitors were taken to the Dearborn Museum following which they returned for the dinner.

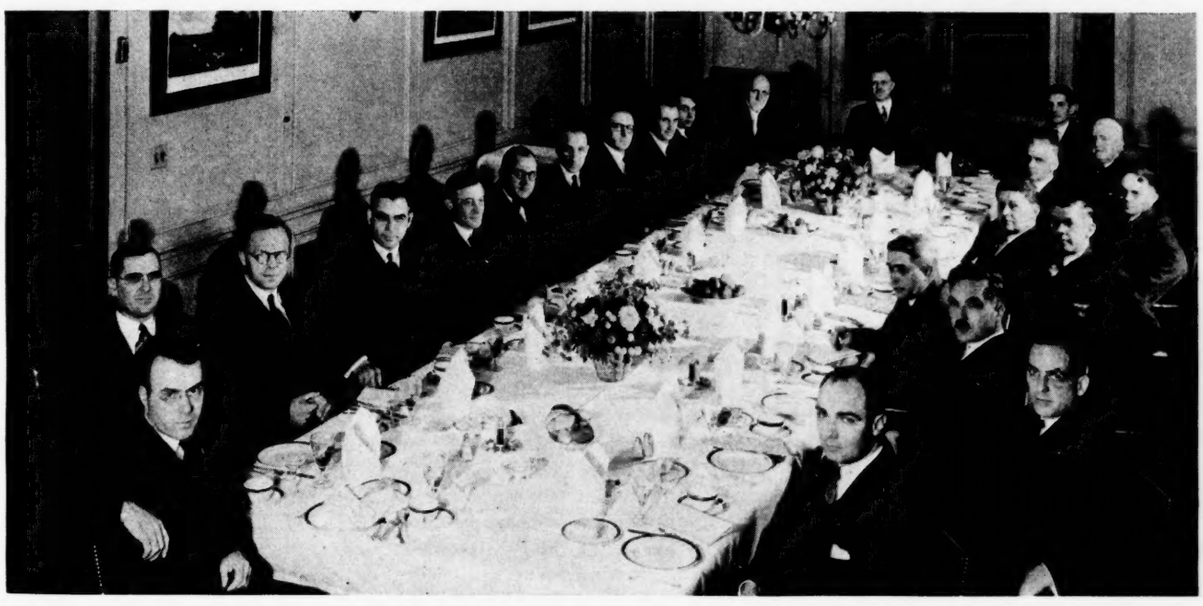
N. D. H. A. Plans New Edition of Handbook

A new edition of the National District Heating Association's handbook is planned by the educational committee, and at the recent meeting of the executive committee, this matter was taken up. A contract with Prof. C. H. B. Hotchkiss, of Purdue University, for editing the new edition was made and approved. This action was necessary inasmuch as the previous edition has become exhausted and there has been considerable demand for a more up-to-date and complete edition of the handbook.

N. D. H. A. Proceedings for 1929

Proceedings of the National District Heating Association for 1929 have been published in a 539-page book constituting the largest volume the association has ever issued.

Subjects covered in this volume are of wide importance, the addresses and papers presented at the Detroit convention are especially valuable. Copies can be obtained through the secretary, D. L. Gaskill, Greenville, O.



Dinner Held for Alex. Dow, President of the Detroit Edison Company — Reading from left to right around the table: A. R. Mumford, E. E. Dubry, Edward Lentz, J. C. Hobbs, H. R. Owens, J. E. Hillemeyer, W. W. Stevenson, O. O. Kastens, L. S. Smith, Earl Shultz, Alex Dow, John W. Meyer, J. C. Butler, D. L. Gaskill, A. D. Spencer, J. H. Walker, H. C. Kimbrough, D. S. Boyden, J. V. Redfield, F. B. Orr, J. E. Seiter, H. J. Baur.

Oil Burners Approved Since November, 1929

IN HEATING AND VENTILATING for December, 1929, and January, 1930, a list of domestic oil burners inspected by the Underwriters' Laboratories was published, including those burners approved up to November 19, 1929. The following list includes domestic burners inspected and passed since November 19, up to and including January 7, 1930.

Oil fuel specifications referred to are those accepted as standard by the burner manufacturers, oil producers and refiners, following the standardization project proposed by the Department of Commerce, and adopted last summer as standard by the industry.

Burners listed are classified as domestic, and are those machines, irrespective of size or heating capacity, which are suitable for use where an attendant is not constantly on the premises. They are provided with automatic devices for the prevention of abnormal discharge of oil at the burner. Burners of this class are intended principally for heating dwellings, but may be permitted by authorities having jurisdiction for use in industrial plants and for heating apartment houses and the like.

All burners listed are mechanical draft burners except where the notation "natural draft" occurs in the column under the heading "Motor Drive."

MANUFACTURER	MOTOR DRIVE	SAFETY CONTROL	IGNITION	FUEL FEED	MARKING	FUEL
Autocrat Oil Burner Corp., Cedar Rapids, Ia.	A.C.	Combustion (Minneapolis-Honeywell "Type U-10-D" Protectorelay with "Type A-4 or B-3" combustion thermostat or Time-O-Stat "No. 77" Lockswitch with "No. 48-H" combustion thermostat).	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing; also "No. 77" on Time-O-Stat Lockswitch and "No. 48-H" on combustion thermostat, or "Type U-10-D" on Minneapolis-Honeywell Protectorelay and "Type A" or "Type B" on combustion thermostat.	Not heavier than No. 3.
Bartles-Minnesota Service Co., (Braden System) St. Paul, Minn.	A.C.	Combustion (Mercoid "Type SDP" Adjustatherm with "Type L" or "Type M-1" combustion thermostat).	Electric or gas-electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on burner base; also "Type OB-3 or OB-4" on strainer; also "Type L" or "Type M-1" on Mercoid combustion thermostat.	Not heavier than No. 3.
Fuelo Engineering Corp., New York, N. Y.	A.C.	Combustion (Minneapolis-Honeywell "Type BFR-1" or "Type A" Protectorelay with "Type B" combustion thermostat).	Gas (expanding pilot).	Gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on base plate; also "Type B" on Minneapolis-Honeywell combustion thermostat.	Not heavier than No. 3.
Hart Oil Burner Corp., Peoria, Ill.	A.C.	Combustion (own manufacture safety switch with Hart Type D combustion thermostat for burners "Types D and DO". Allen-Bradley Type J-1552-Form B magnetic switch with thermal reset with Hart Type D combustion thermostat for burner "Type M").	Gas-electric (transformer), or electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on control housing (Types D and DO), or on burner base (Type M); also "Type D" on combustion thermostat and on fuel feed chamber; also "Type DO" on fire door assembly when used; also Type J-1552 on magnetic switch for burner "Type M".	Not heavier than No. 3.
International Burners Corp., New York, N. Y.	A.C. or D.C.	Combustion (Minneapolis-Honeywell "Type A" Protectorelay with "Type A" or "Model B" combustion thermostat or "Type TIR" Protectorelay with "Type B" combustion thermostat).	Gas (expanding pilot) or electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing; also "Type A" or "Model B" on Minneapolis-Honeywell combustion thermostat.	Not heavier than No. 3.
Progressive Machinery Co. Minneapolis, Minn.	A.C.	Combustion (Minneapolis-Honeywell "Type BFR" Protectorelay with "Type A" combustion thermostat or Time-O-Stat "No. 77" Lockswitch with "No. 48-H" combustion thermostat, or Mercoid "Type SDP" Adjustatherm with "Type M-1" combustion thermostat).	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on burner base; also "No. 48-H" on Time-O-Stat combustion thermostat, or "Type M-1" on Mercoid combustion thermostat.	Not heavier than No. 3.
Real-Oil-Heat Burner Co., Winona, Minn.	A.C.	Anti-flooding device (Detroit Lubricator Type "S").	Gas or manual (high-low flame).	Gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on blower housing; also Type A-3 or Type B-1 on Minneapolis-Honeywell combustion thermostat.	Not heavier than No. 1.
Shaver Brothers, Ltd. (Braden System) Ottawa, Ont., Canada.	A. C.	Combustion (Mercoid "Type SDP" Adjustatherm with "Type L" or "Type M-1" combustion thermostat).	Electric or gas-electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on burner base; also "Type OB-3 or OB-4" on strainer; also "Type L" or "Type M-1" on Mercoid combustion thermostat.	Not heavier than No. 3.
Super Oil Heator Co., The, Pawtucket, R. I.	A.C. or D.C.	Combustion. Own manufacture float switch and combustion thermostatic valve (Types T and G) or Minneapolis-Honeywell "Type DSS" motor switch and "Type B" combustion thermostat (Type B only) or Time-O-Stat "No. 77" Lockswitch with "No. 48-H" combustion thermostat (Types G, SSH, and SC only).	Gas or electric (transformer).	Gravity from supply tank or listed automatic pump or (Types G, SSH, and SC) suction from supply tank.	Underwriters' Lab. label on motor pump unit (Types G, SSH, and SC) or on carburetor housing (Types T and B); also "Types T, B, G, SSH, or SC" on motor pump unit, burner base, and air regulating castings; also "Type B" on Minneapolis-Honeywell combustion thermostat (Type B); also "No. 77" on Time-O-Stat Lockswitch and "No. 48-H" on combustion thermostat (Types G, SSH, and SC); also "Type G" on strainer (Types G, SSH, and SC); also "Type G" on anti-siphon valve (Type G).	Not heavier than No. 2.

Sixty-Eight Exhibitors for A. O. B. A. Exposition

Sixty-eight exhibitors have taken space in the American Oil Burner Association Exposition, to be held at the Hotel Stevens, Chicago, April 7-12, in connection with the seventh annual convention of the association.

Latest developments in burners, accessories, and controls will be on exhibition. These will include temperature and fuel oil control devices, refractory cements, metal tubing, valves, boilers, tanks, motors, pumps, grates, nozzles, strainers, gauges, atomizers, blowers, hot water heaters, etc.

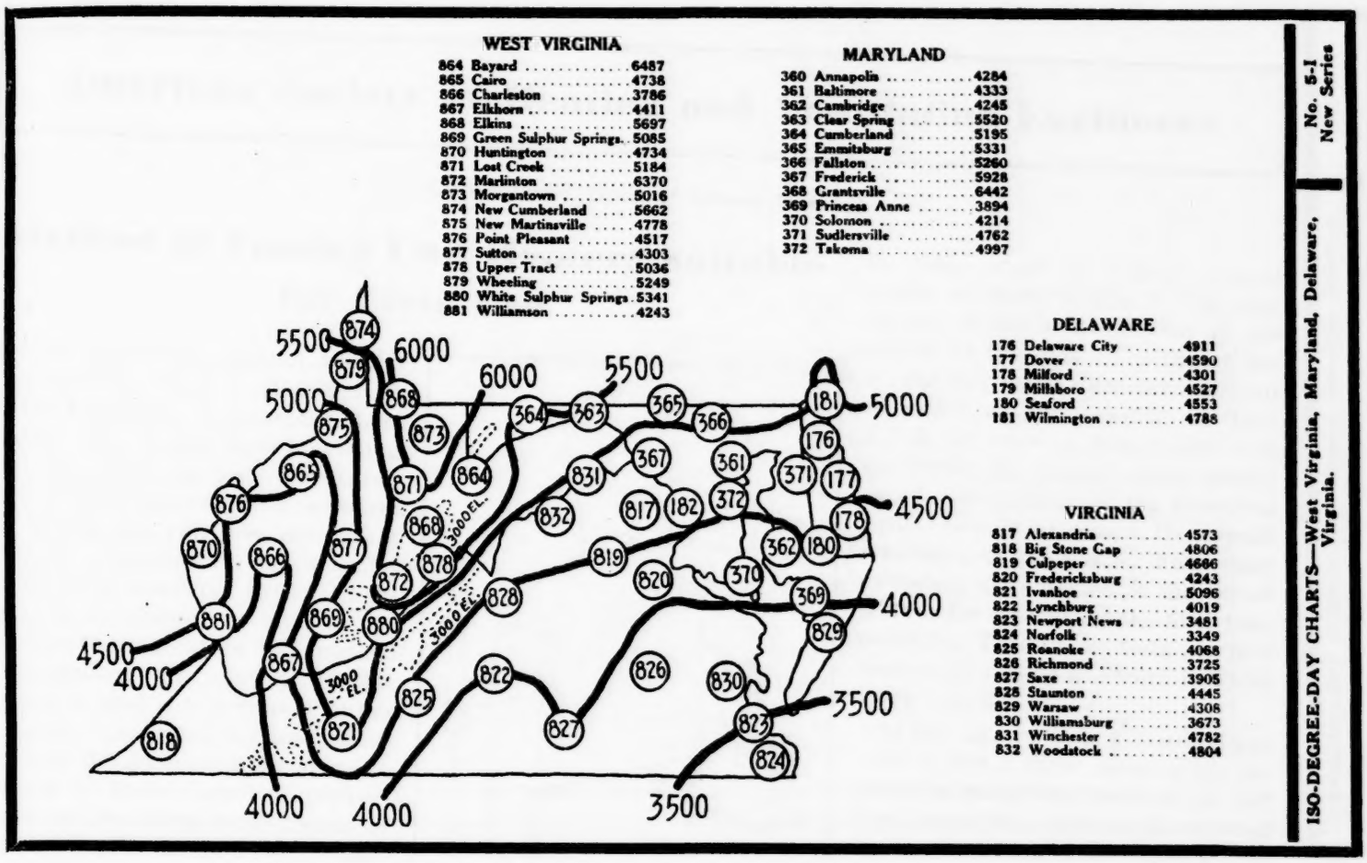
Among the speakers on the convention program will be E. V. Walsh, of the Timken Oil Burner Company, "Manufacturer and Dealer Obligations"; O. P. Harris, Petroleum Heat and Power Company, "The Sale of Oil Burners"; E. S. Brinsley, Credit Investment Trust of New York, "Time Payment Sales"; Carl E. Widney, Kling-Gibson Company of Chicago, "Selling Appeals"; S. E. Andros, Quaker Manufacturing Company, Chicago, "Meeting the Dealer's Needs"; H. W. Sweatt, Minneapolis-Honeywell Regulator Company, "Reduced Temperatures at Night"; Chester Carr, E. W. Carr & Company, Inc., New Orleans, "Oil Versus Natural Gas"; William Webster, May Oil Burner Corporation, Baltimore, "The Importance of Installation Engineering."

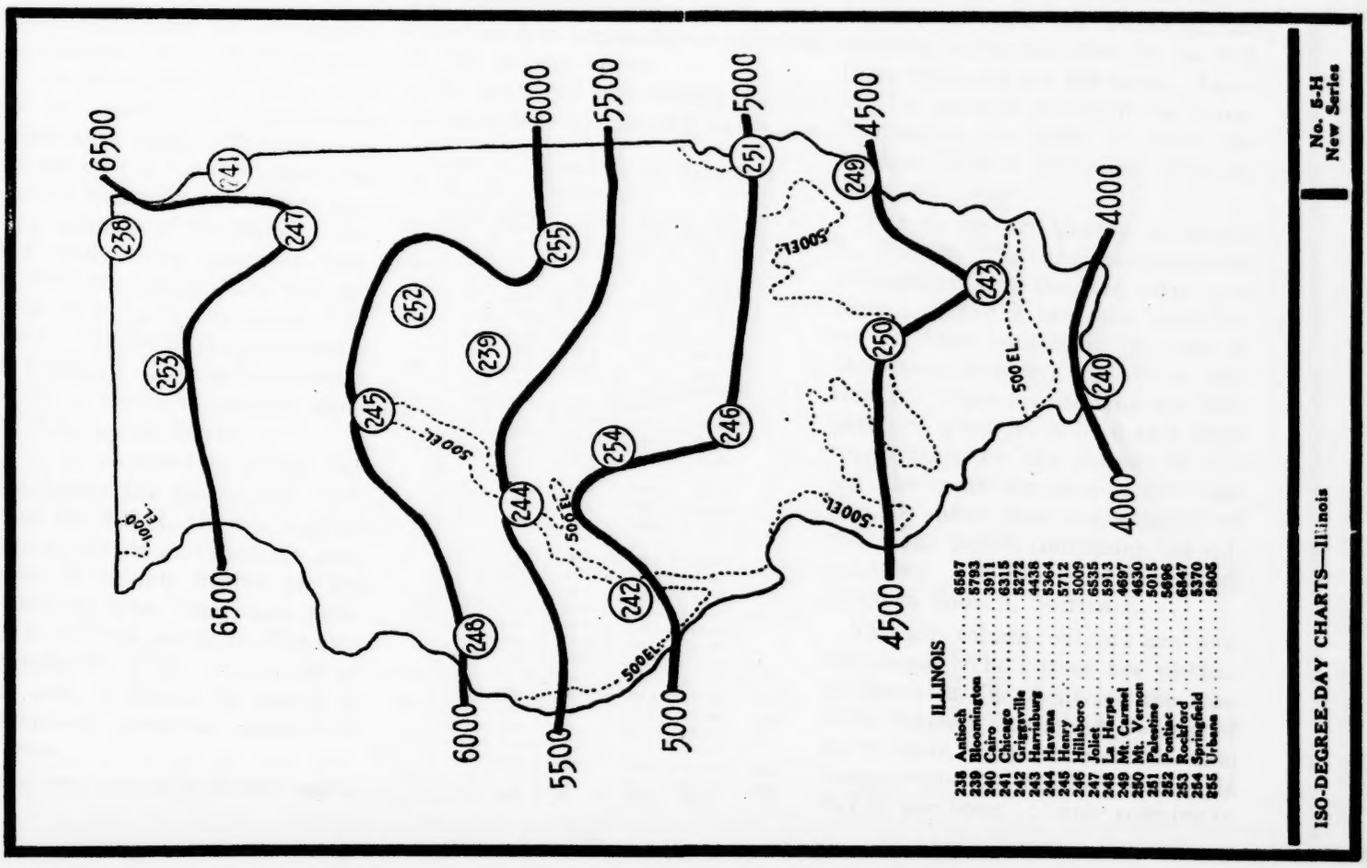
Oil-Burner Shipments for December and January

December shipments of oil burners, as reported by 50 manufacturers whose output constituted 60% of the total for the industry in 1927, were 4780 as compared with 7213 in November. Of this total, 2288 were mechanical draft domestic burners; 1446 were natural draft domestic burners, and the remainder were industrial type burners.

January shipments amounted to 3594, as compared with 4780 in December, 1929, and 3037 in January of last year.

Of this total, 2024 were mechanical draft domestic burners, and 729 were natural draft domestic burners. The remainder were industrial type burners.


WEST VIRGINIA
864 Bayard 6487
865 Cairo 4738
866 Charleston 3786
867 Elkhorn 4411
868 Elkins 5697
869 Green Sulphur Springs. 5085
870 Huntington 4734
871 Lost Creek 5184
872 Marlinton 6370
873 Morgantown 5016
874 New Cumberland 5662
875 New Martinsville 4778
876 Point Pleasant 4517
877 Sutton 4303
878 Upper Tract 5036
879 Wheeling 5249
880 White Sulphur Springs. 5341
881 Williamson 4243
MARYLAND
360 Annapolis 4284
361 Baltimore 4333
362 Cambridge 4245
363 Clear Spring 5520
364 Cumberland 5195
365 Emmitsburg 5331
366 Fallston 5260
367 Frederick 5928
368 Grantsville 6442
369 Princess Anne 3894
370 Solomon 4214
371 Sudlersville 4762
372 Takoma 4997
DELAWARE
176 Delaware City 4911
177 Dover 4590
178 Milford 4301
179 Millsboro 4527
180 Seaford 4553
181 Wilmington 4788
VIRGINIA
817 Alexandria 4573
818 Big Stone Gap 4806
819 Culpeper 4686
820 Fredericksburg 4243
821 Ivanhoe 5096
822 Lynchburg 4019
823 Newport News 3481
824 Norfolk 3349
825 Roanoke 4068
826 Richmond 3725
827 Saxe 3905
828 Staunton 4445
829 Warsaw 4308
830 Williamsburg 3673
831 Winchester 4782
832 Woodstock 4804
3000 FT.
ISO-DEGREE-DAY CHARTS—West Virginia, Maryland, Delaware, Virginia.
No. 5-I New Series



Heating and Ventilating's Data Sheets Nos. 5-H and 5-I

American Society of Heating and Ventilating Engineers

(*Supplementary Report of Annual Meeting*)

Method of Testing Unit Heaters Suitable for Field Use

IN his paper presented at the annual meeting, Prof. L. S. O'Bannon of the University of Kentucky, Lexington, Ky., stated that in testing unit heaters it has been the experience of most observers that the warm air leaving the unit does not have a uniform temperature or velocity. Accuracy in observing the final temperature of the air is vital to the condensate-temperature rise method of computing air volume. If this method is used it is necessary either to obtain a weighted average, which requires the determination of velocities, or to force a uniform temperature by providing some means of mixing the air. As Professor O'Bannon pointed out, the latter system generally is favored.

He also described the method by which the air volume output may be obtained accurately with a minimum of auxiliary equipment. The method may be used in the laboratory or in the field.

It has been named the condensate-nozzle method. The underlying principles are the same as those upon which the condensate-temperature rise method is based. The heat output of the unit is found in the usual manner by measuring the steam condensing capacity of the heater. Air volume outputs are computed indirectly from the temperature rise and the heat given up by the steam. The distinctive feature of the condensate-nozzle method is the graphical means employed to arrive at certain unobserved final temperatures.

Let it be required to obtain for three different fan speeds, say 1750, 1160 and 870 R.P.M., the heat output, air volume output and final air temperature of a unit heater of the draw-through type. The steam pressure is to be 5 lbs. per sq. in. The unit is arranged for a heat output test as shown, and, it should be noted, is free from any abnormal restrictions to air flow.

Three heat output tests are made,

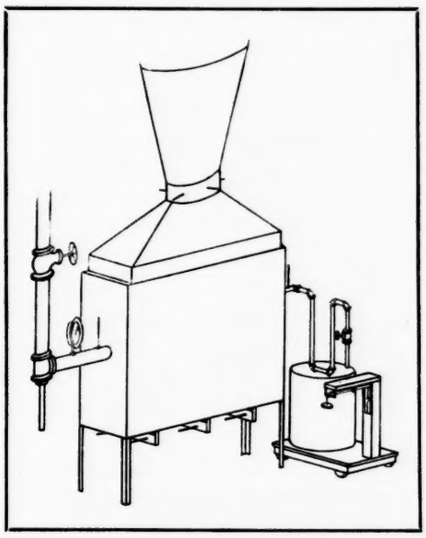


Fig. 1. Unit Heater with Venturi Nozzle for Air Volume Test

as near the specified speeds as possible. Let it be assumed that these tests yield the data as given in Table 1, Section A. No observations of final temperature were made and therefore it is impossible to calculate the air volume output.

The next step is to remove the diffusing outlets of the unit and place in their stead a venturi-shaped nozzle, as shown in Fig. 1. The inlet section of the nozzle covers all the outlets of the unit. The throat has a relatively small diameter sufficient to cause an air velocity of 1000 F.P.M. or more as determined from the lowest air volume output anticipated. The purpose of the diverging outlet cone is to reduce the overall resistance of the nozzle. Four thermometers are inserted at the throat section for measuring the final temperature. Three more tests are now made with results as shown in Table 1, Section B.

If the data of tests 4, 5 and 6 are used to plot a curve showing the relation between final temperature and heat output this curve can be referred to, to obtain the final temperatures for tests 1, 2 and 3. However, the relation between heat output and final temperature varies with the entering air temperature. Therefore it is necessary to reduce the data of tests 4, 5, and 6 to the same entering air temperature as tests 1, 2 and 3. This requires three separate transformations since the values of the entering air temperature for the first three tests are not the same. Leaving the method by which the transformations are made for later discussion, Table 1, Section C, gives the corrected values.

The curves are plotted as shown in Fig. 2. The final temperatures corresponding to the heat outputs of tests 1, 2 and 3 are read from the curves, thus completing the data of these tests as shown in Table 1, Section D. Since an entering air temperature of 60° F. is used as a basic temperature for the purpose of rating, the transformation to this base may be made most conveniently at this stage before continuing the calculations. The converted figures are given in Table 1, Section E.

The air volume outputs are now calculated. The curves are plotted, as shown in Fig. 3, giving the relations between fan speed, volume of air in cubic feet per minute, the final temperature and the heat output in B.T.U. per hour. It only remains to

TABLE 1. SUMMARY OF TEST DATA

Section	Test No.	Fan Speed R. P. M.	Inlet Air Temp.—F.	Outlet Air Temp.—F.	Heat Output B. T. U. per hour	Air Volume cu. ft. per min. at Fan
A	1	1751	87.9	....	182,900	....
	2	1184	87.8	....	135,500	....
	3	788	90.7	.....	97,600	....
B	4	1752	68.9	133.0	205,300	....
	5	1175	69.7	139.8	153,400	....
	6	794	74.1	149.2	109,600	....
C	4	1752	87.9	145.1	179,600	....
	5	1175	87.9	150.6	134,800	....
	6	794	87.9	156.7	99,200	....
	4	1752	87.8	145.0	179,600	....
	5	1175	87.8	150.5	134,800	...
	6	794	87.8	156.6	99,200	...
	4	1752	90.7	146.8	175,600	....
	5	1175	90.7	152.3	132,000	....
	6	794	90.7	158.3	97,200	....
D	1	1751	87.9	144.9	182,900	....
	2	1184	87.8	150.5	135,500	....
	3	788	90.7	158.2	97,600	....
E	1	1751	60	126.8	221,000	3403
	2	1184	60	133.8	164,000	2310
	3	788	60	141.3	120,900	1567
F		1750	60	126.8	221,000	3390
		1160	60	134.2	162,000	2280
		870	60	139.7	130,000	1720

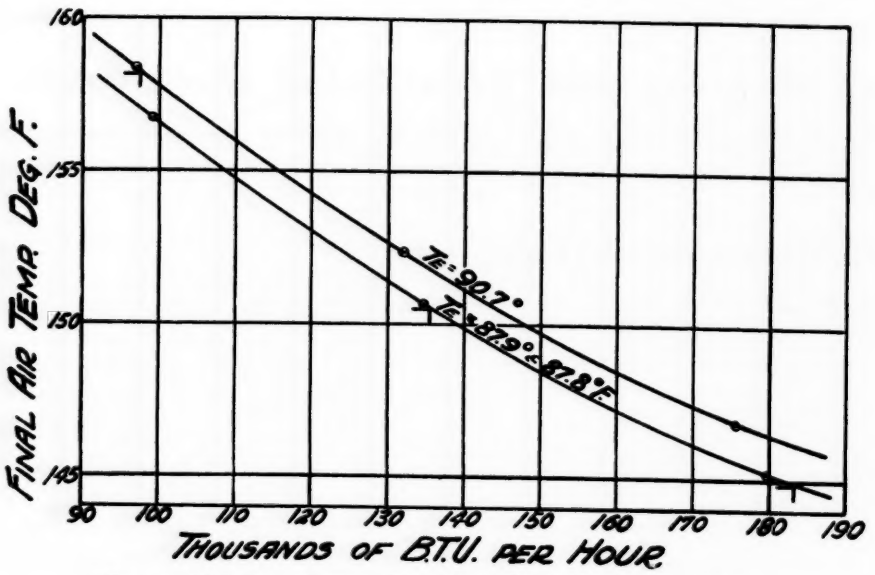


Fig. 2. Relation of Heat Output to Final Air Temperature

select from these curves the proper values corresponding to the three fan speeds specified at the beginning. The results are summarized in Table 1, Section F.

If it had been required to find the output of the unit at only one speed, for example, at the rated speed of an alternating-current motor, the three points required for the curve in Fig. 2 could have been obtained just as readily by dampering the air flow at the outlet of the nozzle or by inserting orifices at the throat.

Although the diverging cone of the nozzle helps to reduce the overall resistance and minimizes the hazard of extrapolating to get the final temperature at the maximum output, this cone is not essential. If there is some means available for increasing the normal speed of the fan, it is possible to exceed the normal maximum output, eliminating extrapolation entirely and permitting the use of a nozzle of higher resistance. A substitute motor of higher speed may be used; a d.-c. motor may be run for the short period of the test at a few hundred revolutions above its normal speed; an auxiliary motor with belt drive may be used.

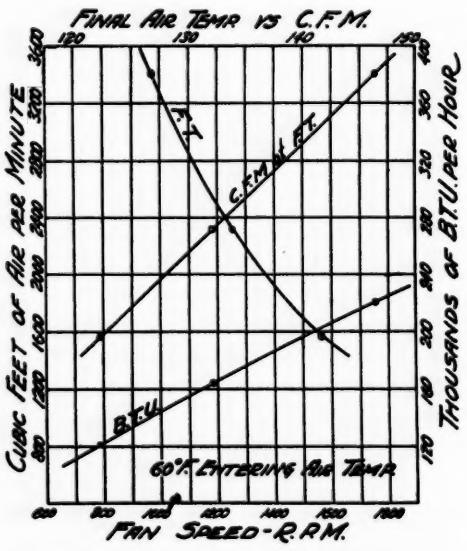


Fig. 3. Relation of Fan Speed, Output, Volume and Final Temperature

It should be noted especially that this method is not dependent upon the accurate reproduction of free delivery conditions within the confines of the duct placed over the outlets. The method does not prohibit the use of an auxiliary fan to overcome the resistance of the collecting nozzle or to exhaust the heated air out of the test room, but the method emphasizes the fact that the auxiliary fan is not essential from the standpoint of totally equalizing or balancing the resistance of the nozzle; furthermore, the method is not concerned with the volumetric proportions of the nozzle, or other mixing device which may be substituted for it.

Pipe and Orifice Sizes for Small Gravity Circulation Hot Water Heating Systems

Based upon a series of tests made at the Engineering Experiment Station of the Agricultural and Mechanical College of Texas, in cooperation with the A.S.H.V.E., Elmer G. Smith and Dr. F. E. Giesecke presented a paper containing tables and other data for figuring main sizes and riser sizes for small hot water systems, together with tables giving the diameters of orifices to be used with various sizes of radiators for different heights above the mid-point of the heater. Another table gave the sizes of orifices for use with valves that come equipped with them, and still another table gave the proper settings for use with valves with adjustable calibrated orifices.

In connection with the paper the authors illustrated sheet-copper orifices which can be made by the contractor and inserted in the unions.

To illustrate the application of the tables and the use of the orifices, the authors worked out a one-story residence problem covering, among other points, method of selecting orifice sizes when the orifices are rated in square feet of vapor radiation, methods of determining the proper settings for valves having an adjustable orifice calibrated in square feet of vapor radiation and methods of dealing with branched circuits.

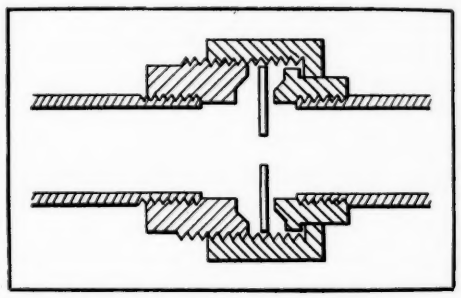


Fig. 1. Orifice in Union Before Tightening

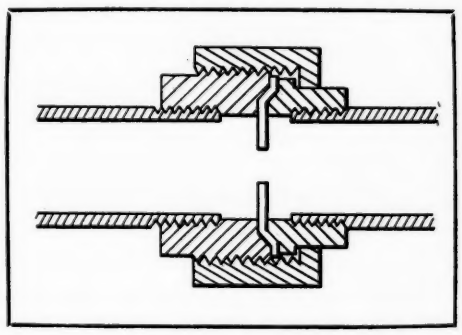


Fig 2. Orifice in Union After Tightening

Covering of mains, systems having sealed expansion tanks, an explanation why radiators at the ends of lines frequently do not heat well, and why radiators on lower levels frequently do not function well when connected to the same riser with high radiators, are described in the report.

The paper concluded with suggestions for improving, through the use of orifices, the circulation in old systems that do not heat properly.

Air Infiltration Through Brick Wall Construction

G. L. Larson

D. W. Nelson

C. J. Braatz

Data on air infiltration through plain, plastered and painted brick walls were given in this paper which is in the form of a conclusion to a preliminary report on the same subject. Two types of brick were used in the construction of these walls—a hard face brick and a more porous type, commonly known as Chicago clay brick. The dimensions of the hard brick in inches, in the order of length, width and thickness were 8⅛ in., 3¾ in., 2 11/32 in., and for the porous type 8 1/16 in., 3 9/16 in., 2 5/16 in. The average thickness of the vertical and horizontal mortar joints for all walls was approximately ¼ in. and ½ in. respectively. Three of the walls were slushed with cement-line mortar, the other with lime mortar. The walls were constructed in a way to differentiate between good and poor workmanship.

Plain brick walls vary greatly with respect to air infiltration. Of the three factors—brick, mortar and workmanship—workmanship seems to be of most importance, the composition of the mortar as to cement and lime content next in importance, and the brick the least important. The infiltration for the 13-in. plain brick walls tested ranged from 2.71 to 10.35 cu. ft. per hr. per sq. ft. of walls.

Gypsum plaster, when properly applied, stops almost all infiltration. The results show that plastering stopped about 96% of the leakage of the plain brick wall. Plastering directly on brick seemed to be slightly better than on metal lath with a furring space. The difference is small, and the saving due to plastering directly on the brick would be negligible as compared to the saving in heat transmission effected by the furring space in the other construction.

The effectiveness of plaster in stopping infiltration in actual building construction is probably much less than that found in these tests. Cracking of the plaster, imperfect sealing of the plaster sheet at the wood trim, such as at the baseboard, would decrease the effectiveness greatly. A test made of a baseboard equipped wall, with a furring space, showed an effectiveness of only 50% of that obtained with a perfectly sealed plaster wall.

Two ordinary coats of a linseed oil paint applied directly to the surface of a porous brick wall reduced the leakage by 9%. A third coat applied with extreme care made the total reduction in infiltration 28%.

One heavy coat of cold water paint applied directly to the surface of a hard brick wall reduced the leakage by 50%.

A study made on a typical 10-story office building, considering all walls to be 13-in. brick with furring space, metal lath and plaster, indicates that

TABLE 1—INFILTRATION IN CU. FT. PER HR. PER SQ. FT. OF PLAIN WALL

Drop in Pressure Inches of Water	Wind Vel. Miles Per Hr.	Wall No. 2	Wall No. 3	Wall No. 4	Wall No. 5	Wall No. 6
0.012	5	0.34	0.46	0.71	0.51	1.60
0.048	10	1.30	1.64	2.36	1.83	5.30
0.108	15	2.71	3.45	5.05	3.85	10.35
0.192	20	4.59	5.76	8.31	6.34	16.28
0.300	25	6.85	8.38	12.03	9.22	23.05
0.431	30	9.31	11.30	16.00	12.40	30.80

Wall No.	Kind of Workmanship	Kind of Mortar	Kind of Brick
2	Good	Cement-lime	Hard
3	Good	Lime	Hard
4	Good	Cement-lime	Porous
5	Poor	Cement-lime	Hard
6	Poor	Lime	Porous

TABLE 2—RESULTS OF TESTS ON WALL 4

Wind Vel. Miles per Hour	Drop in Pressure Inches of Water	Plain Wall	Furring Metal Lath Plaster	Plaster Removed	1 Coat White Lead and Oil	2 Coats White Lead and Oil	3 Coats White Lead and Oil
5	0.012	0.71	0.05	0.65	0.61	0.61	0.52
10	0.048	2.36	0.14	2.52	2.38	2.31	1.87
15	0.108	5.05	0.28	5.22	4.97	4.76	3.75
20	0.192	8.31	0.47	8.64	8.31	7.78	6.08
25	0.300	12.03	0.68	12.55	12.07	11.27	8.69
30	0.431	16.00	0.92	16.87	16.03	15.18	11.62

TABLE 3—RESULTS OF TESTS ON WALL 5

Wind Vel. Miles per Hour	Drop in Pressure Inches of Water	Plain Before Plastering	Furring Metal Lath and Plaster	Plain After Plaster was Removed	1 Coat Cold Water Paint	Cold Water Paint Washed off	1 Coat White Oil Paint	2 Coats White Oil Paint
5	0.012	0.51	0.02	0.65	0.27	0.27	0.27	0.27
10	0.048	1.83	0.07	2.30	1.03	1.03	1.03	1.03
15	0.108	3.85	0.15	4.61	2.22	2.17	2.13	2.03
20	0.192	6.34	0.25	7.45	3.77	3.37	3.27	3.08
25	0.300	9.22	0.34	10.87	5.58	4.54	4.40	4.12
30	0.431	12.40	0.42	14.86	7.67	5.77	5.61	5.19

TABLE 4—RESULTS OF TESTS ON WALL 6

Wind Vel., Miles per Hour	Drop in Pressure, Inches of Water	Plain Wall	Plastered Directly on Brick
5	0.012	1.60	0.03
10	0.048	5.30	0.09
15	0.108	10.35	0.18
20	0.192	16.28	0.29
25	0.300	23.05	0.40
30	0.431	30.80	0.52

the infiltration heat loss through the brick would range from 6 to 25% of the infiltration heat loss through the windows and doors where the plaster is not properly sealed. For perfect sealing of the plaster, these percentages would be reduced to 0.5 to 2.7, respectively. This would indicate that the infiltration loss through brick walls with properly sealed plaster at the baseboard and other wood trim is negligible in making calculations for heat loss.

Each of the walls was subjected to wind pressures corresponding to wind velocities ranging from about 5 to 30 mi. per hr. All of the walls were permitted to age at least five months before the tests were made. Walls No. 4 and 5 were later plastered on metal lath and furring space for further testing. After removal of the plaster, Walls No. 4 and 5 were used for the determination of the effectiveness of several kinds of paint on infiltration. Wall No. 6 also was re-tested with an application of plaster directly on the brick, without lath. Wall No. 7 was used only to determine the effectiveness of plaster, no tests being made on the plain brick wall.

As will be noted from Table 1, Wall No. 6 is considerably poorer from the infiltration standpoint than the other walls. Wall 6 was constructed of porous brick and lime mortar applied with poor workmanship. By improving the workmanship and using cement-lime mortar, rather than lime mortar, in Wall 4, the infiltration loss is cut to a little less than 50%.

One of the conclusions indicated by the test is that it is more important to use the best mortar and workmanship on porous brick walls than on hard brick walls.

It also was noted that in each case plastering reduced the infiltration to a very low value. Plaster applied directly to the brick was more effective in preventing infiltration than plaster applied on lath, with a furring space, the percentage reduction being the greatest (98%) for Wall 6, which had plaster applied directly.

Application of one coat of interior cold water paint reduced the leakage at 15 mi. per hr. on Wall 5 by 52%. When the cold water paint was washed off and the wall treated to two coats of a white oil paint, the first coat gave a reduction in leakage at 15 m. per hr. of only 2%, while the second coat gave an additional reduction of 4.5%, or a total of 6.5%. When a third coat was applied, an additional 19% reduction was secured or a total reduction of 28% for the three coats.

Additional tests emphasized the importance of sealing the edges of the plaster sheet at the baseboard, if the value of plaster in stopping air infiltration is to be realized in building construction.

Absorption of Solar Radiation

F. C. Houghten

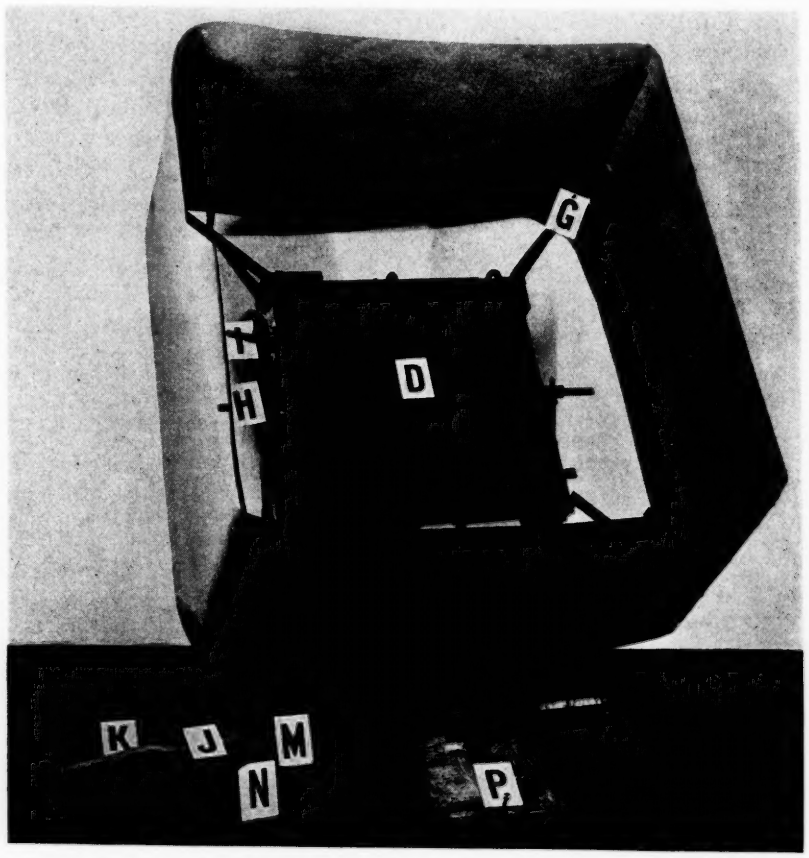
Carl Gutberlet

In this paper the authors presented the results of an investigation on the absorption of solar radiation in its relation to the temperature, color, angle and other characteristics of the absorbing surface. The subject, they pointed out, is daily becoming of greater importance to the heating and air-conditioning engineer. Increase in the application of cooling to buildings in summer is an important factor in this growth of interest. With more scientific air conditioning, the relative effect of heat from the sun on heating requirements and proper temperature distribution indoors becomes more noticeable.

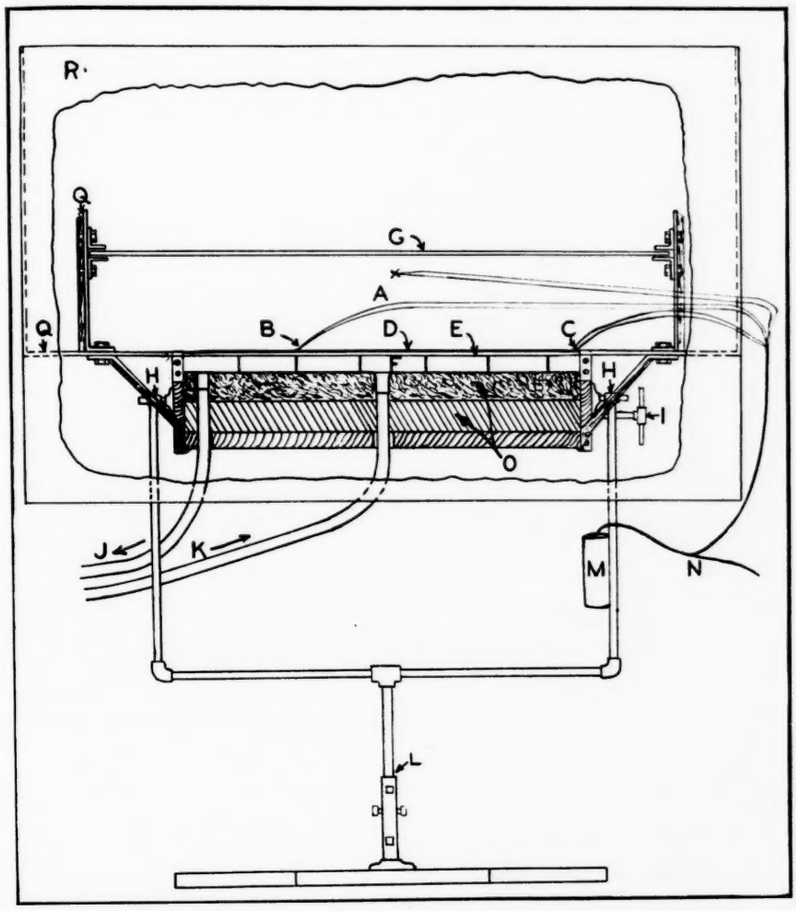
Reference is made to the fact that in order to establish data on this subject, the Research Laboratory recently made a study of the heat passing through certain types of roof construction and the temperature attained by the roof on hot summer days. This study was made possible through the use of the Nicholls heat meter.

For collecting the data for the present paper, an apparatus was designed consisting essentially of a two-foot square surface D, made by waxing black oilcloth to a 1/16-in. thick Nicholls heat meter E, which, in turn, was waxed to the copper water cooler F. The opposite side of the cooler was insulated by 1 in. of hair felt and 2 in. of corkboard.

This arrangement made a wall unit 2 ft. square by about 5 in. thick, which was supported by horizontal and vertical pivots, so that the plane



Set-Up for Measuring Rate of Heat Absorption from the Sun



Set-Up for Measuring Rate of Heat Absorption from the Sun

A—Air Temperature Thermocouple. B—Surface Temperature Thermocouple. C—Heat Meter Leads. D—Surface Studied. E—Heat Meter. F—Water Cooled Plate. G—Glass. H—Horizontal Pivot. I—Sight for Adjusting Angle of Surface. J—Water to Circulating Pump and Tank. K—Water from Circulating Pump and Tank. L—Vertical Pivot. M—Cold Junction Bottle. N—Cable to Potentiometer. O—Insulation, Hair Felt and Cork Board. P—Sun Dial. Q—Frame for Supporting Paper Shield and Glass. R—Paper Shield.

surface studied could be placed at any angle with the direction of the sun's radiation.

A skeleton framework was arranged so that a 3-ft. square plate of double strength window glass, ⅛ in. thick, could be placed symmetrically between the surface and the sun and 6 in. from the surface. The same skeleton framework held a paper shield designed to protect the surface studied from wind but not to interfere any more than necessary with natural convection currents. This paper shield in no way shaded the surface studied from the sun's rays.

All of the tests were made on a flat roof of a garage building of the U. S. Bureau of Mines in Pittsburgh.

The total energy emitted by the sun figured normal to the direction of radiation at sea level is given by Bigelow as about 332 B.T.U. per sq. ft. per hr. or 1.38 sq. ft. of equivalent steam radiation on a clear day.

Heat absorption by a black oil-cloth surface perpendicular to the sun's radiation was found to be as high as 273 B.T.U. per sq. ft. per hr. on a day which would be considered bright in Pittsburgh. This compared with a total energy of 332 B.T.U. per sq. ft. per hr. emitted by the sun, figured normal to the direction of radiation at sea level and is equivalent to 1.38 sq. ft. of steam radiation.

Lamp-black painted surfaces, red-brick-dust painted surfaces and aluminum-bronze painted surfaces perpendicular to the sun's radiation showed 94.0%, 63.4% and 28.2% as high a rate of absorption as the black oil cloth.

The difference in retention of absorbed heat by surfaces having temperatures different from the air in contact with them apparently can be satisfactorily corrected for a black surface by assuming a surface transmission coefficient of 2.0 B.T.U. per sq. ft. per hr. per deg. temperature difference between the surface and air, when this temperature difference is not greater than 20°.

A single pane of double-strength window glass placed so that the sun's rays must pass through it before it impinges on the surface reduces the heat absorption of that surface by from 8.9% to 16.5%, when the impingement is normal. For smaller angles of impingement the glass retards a greater per cent of the radiant energy.

The rate of absorption of heat from the sun's radiation by a surface at any angle with the direction of radiation may be satisfactorily computed by the equation $Q = H \sin \theta$ where Q is rate of absorption for the angle θ and H is the rate of absorption for the same surface normal to the direction of radiation.

Test of Disc and Propeller Fans

A. I. Brown

Among the papers presented to the A.S.H.V.E. at its annual meeting in Philadelphia in January, was one by Prof. A. I. Brown, associate professor of heating and ventilating at Ohio State University, devoted to a report of tests conducted at the university on disc and propeller fans, with particular reference to the newer designs having blades similar in shape to the airplane propeller.

Commercial tests of fifteen or more fans of various sizes and designs were made in the Mechanical Engineering Laboratory of the university. The present data are the result of experimental work which is the outgrowth of these commercial tests.

Professor Brown gave an interesting example illustrating the reliability of the A.S.H.V.E. Standard Code for Testing Centrifugal and Disc Fans, where manufacturer A had claimed that his fan had a greater capacity than a similar-sized fan of manufacturer B. According to this code a test is made by observing the pressure in an air-tight chamber where a propeller fan is blowing into the chamber and a similar fan of slightly greater or less capacity is exhausting air from the chamber. Then, noting that an equal

pressure, but of opposite sign, exists when the fan are interchanged, A's fan was set up so as to blow into the air chamber, while B's fan was exhausting, with the result that a vacuum of 0.067 in. of water was created in the chamber, showing that A's fan was not supplying enough air to compensate for that which was being drawn out by B's. When the fans were interchanged, the pressure in the chamber was found to be 0.065 in. of water, or substantially equal in magnitude to the vacuum which was observed in the former case.

One of the interesting facts brought out by the tests was that disc and propeller fans, normally, if not always, will have a greater capacity when discharging through a short length of duct of somewhat greater diameter than that of the fan and that a short duct, even of the same diameter as the fan opening, in the case of an airplane propeller fan, will cause an appreciable increase in capacity.

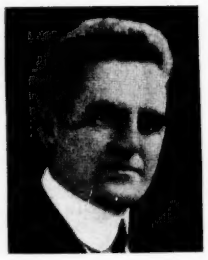
Referring to the claim often made that the airplane propeller is the most efficient device yet known for moving air, the author's tests showed that if this statement is limited to the free discharge of air, or to operation at or near the maximum capacity of the airplane propeller fan, it apparently is true. However, the efficiency of a propeller fan is dependent not only upon the design of the propeller itself, but to a great extent upon the means for preventing leakage at the tips of the blades.

Propeller fans for operation against the higher static pressures have merit with reference to small space requirements and relatively low cost, as compared with centrifugal fans, but do not show as high efficiencies as are found in tests of centrifugal fans.

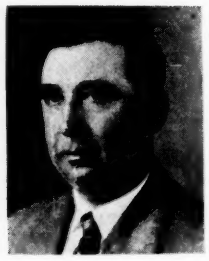
Analysis of fan performance as published by the manufacturers of a considerable number of disc and propeller fans shows unreasonable values of fan capacity and efficiency. The calculated value of fan efficiency and the comparison of the capacity rating with the computed capacity of a perfect fan are serviceable checks on the reliability of catalog data.

Although the A.S.H.V.E. code is a little more difficult to apply than some of the more simple methods, the author testified to its reliability. In addition, this method discloses important features of fan performance which are likely to be overlooked in tests by the older and less accurate methods.

Pressure Difference Across Windows in Relation to Wind Velocity

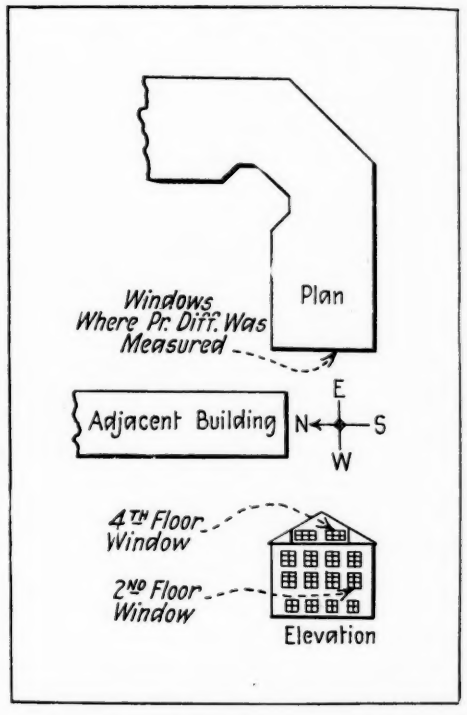


J. E. Emswiler



W. C. Randall

While there is a considerable mass of data from laboratory research showing what the leakage is for various kinds of windows for any specified pressure difference, the authors pointed out that there is little definitely known about what the pressure difference actually is, or is likely to be in a given building. In the absence of knowledge regarding this quantity, it is usual to assume a certain wind velocity appropriate to a given locality and take the leakage as that corresponding thereto, which is equivalent to assuming a certain pressure difference at the window. The usual figure is 15 mi. per hr.

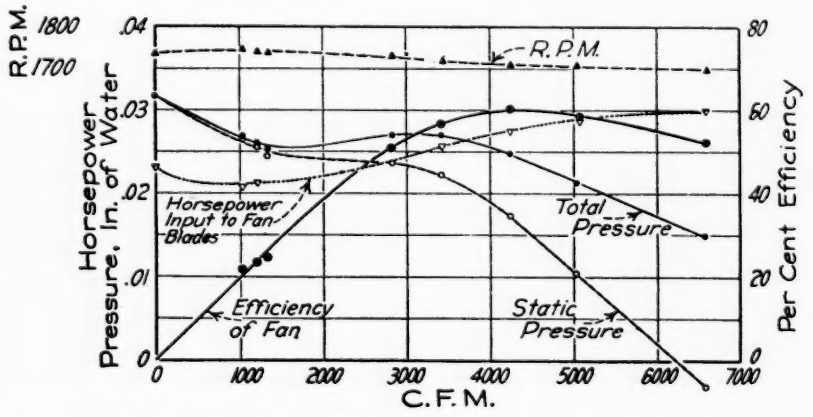


Location of Windows in Building Chosen for Pressure Difference Tests

The A.S.H.V.E. *Guide* recommends a further allowance for the direction of the prevailing wind in any locality, which shall be done by adding 15% to the infiltration losses on the sides of the building exposed to the prevailing wind. One table in the *Guide* is figured at 80% of the leakage as determined from experiments to make allowance for an opposing pressure built up on the inside as a result of air being forced in by the excess wind pressure on the outside.

In the test here described, a record was made of the pressure difference across two windows in one of the buildings of the University of Michigan, covering a period of 45 days, during the winter of 1929.

In the chart shown on Page 111, curve D represents the average pressure difference observed at the second and fourth floor windows. Curve C is the pressure computed from the wind velocity. The ratio of the average pressure difference to the wind pressure is represented by curve E and this is the relation that is the principal objective of this part of the study. Up to a velocity of 11 mi. per hr., the pressure difference exceeds the wind pressure as a result of the temperature effect. Above 11

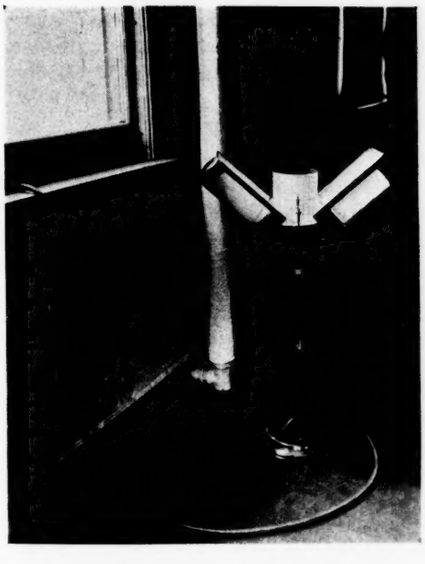


Test of a Two-Blade Airplane Propeller Fan

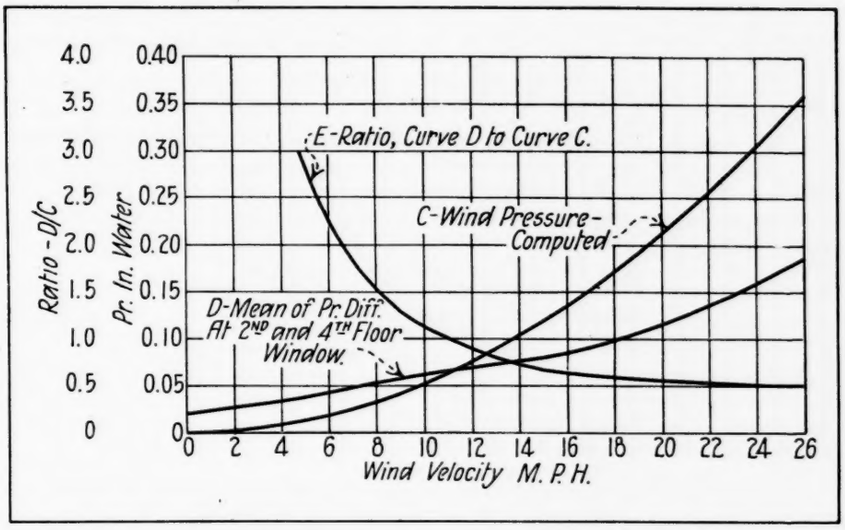
mi. per hr., it will be noted, the pressure difference is less than the wind pressure and it is interesting to note that curve E seems to approach and become constant at about the value of one-half, in the region of high wind velocities.

From a study of the prevailing winds, the authors stated, the value of 20 mi. per hr. would appear to represent a reasonable value for wind velocity for those sides of the building exposed to the prevailing wind. Having chosen 20 mi. per hr. as a basis, curve E on the chart would indicate that the actual pressure difference across the windows is about 0.55 of the pressure computed from this wind velocity, which means that the leakage is about 75% of the amount corresponding to the pressure computed from the wind velocity, since leakage quantity is approximately proportional to the square root of the pressure difference. In other words, the factor to be applied in the 1929 *Guide* tables to allow for building up of inside pressure should be about 75% in this case.

The authors pointed out, however, that the practice of allowing an additional 15% in leakage loss for the sides of a building exposed to the prevailing wind may not provide an adequate margin of heating surface on both sides. For example, if 15 mi. per hr. be taken as the wind velocity upon which to figure infiltration on the less exposed sides, the leakage per foot of sash crack of a double-hung weatherstripped wood window is 11.7 cu. ft. per hr.



Recording Gauge for Measuring Pressure Difference Across Windows



Relation of Measured Pressure Difference at Windows to Wind Pressure with Wind from Direction of Exposure

It has been shown that a reasonable value to be taken for wind velocity from prevailing directions is 20 mi. per hr., for which the leakage is 22.9. Thus, in the case studied, the leakage of windows, under the more extreme conditions on the more exposed sides, is nearly twice as much as that on the less exposed sides, instead of only 15% greater. If this is true of infiltration loss, state the authors, it is also true of transmission loss, although probably in a different ratio.

Michigan Chapter Guests of Detroit Edison

Members of the Michigan Chapter were the guests of the Detroit Edison Company, February 17, at the Delray Power Plant; 160 were in attendance.

Following the dinner, President William G. Boales called the meeting to order and a report was heard from William J. Whelan, chairman of the entertainment committee, who outlined the program for the March meeting.

President Boales then introduced George Giguere, who was awarded a gold watch at the Philadelphia Exposition for obtaining the largest number of new members during the recent membership campaign. Mr. Giguere, as well as Edward M. Harrigan and S. S. Sanford, commented upon the very successful exposition and convention held in Philadelphia.

The meeting was turned over to E. E. Dubry, of The Detroit Edison Company. Mr. Dubry welcomed the assembly and introduced Axel Hellstrom of Chicago, who gave an exhibition in mind reading.

B. W. Thompson of The Detroit Edison Company, discussed many mechanical features connected with the Delray Power Plant, in which the operating steam pressure is 400 lbs. with a steam temperature of 725°. The steam piping is of the 600-lb. seamless steel construction and the fittings are of cast steel. Pipe expansions as high as 6 in. in 100 ft. have been noted in this plant. No high-pressure steam lines are welded but some of the low-pressure service lines are welded. Each stoker consumes an average of 17 tons of coal per hr.

Mr. Thompson went into details as to the cost of transmission of power (about 55% of the total cost), the fact that the Delray turbines are interchangeable with their Trenton Channel Plant and many other interesting facts which were enthusiastically received by his audience.

Sabin Crocker, of The Detroit Edison Company, next delivered an address on heating and ventilating the Delray Power House. In general, air is drawn into the turbine room through windows in the summer and exhausted by means of a fan exhaust at the roof line. The exhaust fan is so connected that this air can be discharged to the forced draft fans in the winter time, or can be exhausted to the atmosphere in warm weather. In cold weather the new air, instead of being drawn through windows, is drawn through heater coils so that the air is tempered before it enters the building.

Forced draft fans in the power house also draw hot air from the boiler room which, of course, tends to keep the boiler room from being so intensely hot and at the same time allows the forced draft fans to discharge tempered air instead of cold air to the boilers.

Mr. Crocker has developed an idea which is meeting with much success, the window sweeping system which is employed in the turbine room, which

not only takes care of the heat loss through the windows but eliminates to a large degree, the collection of condensation on the ceiling of the turbine room. Air is drawn from the outside by means of a full housed type of fan through heater coils, is discharged through ducts which are built into the building construction and carried to a slot in the window ledge and discharged at a high velocity, vertically over the glass area of the window. There is a variable control on the widths of the slot so that the air quantity can be adjusted.

William Boales, on behalf of the Michigan Chapter, thanked The Detroit Edison Company for their hospitality and the guests were taken through the Delray Power Plant on a trip of inspection.

Correlating Thermal Research

Some indication of the extent to which thermal research is being conducted in the United States is furnished in a newly-issued directory of the Association for Correlating Thermal Research. This pamphlet was distributed at the recent annual meeting of the A.S.H.V.E. in Philadelphia, and is published from the headquarters of the association, 4800 Forbes St., Pittsburgh, Pa. All of the universities and other institutions are listed, together with details of the thermal research being conducted at each one.

A list is given of the government bureaus carrying on thermal research work, and of the technical societies, associations and other organizations engaged in this form of research. No less than fourteen private laboratories are included. The manual concludes with an index of subjects under investigation at the various institutions. It makes an imposing presentation, both in number and variety. Size 6 x 9. Pp. 28.

Membership Drive

First prize in the membership drive of the A.S.H.V.E., as announced at the annual dinner of the society, goes to George H. Giguere of the Michigan Chapter. Mr. Giguere had a record of having secured 49 new members. Second prize went to Edwin C. Evans of the Pittsburgh Chapter with 29 new members, and third prize, to William G. Hillen of the New York Chapter with 26 members. W. R. Blackhall, Ontario Chapter, secured 4 members; Robert S. Arnold, Philadelphia Chapter, 3 members; William P. McFarland, Illinois Chapter, 3 members.

As a result of the contest the Michigan Chapter was awarded the banner of the society.

New Society Headquarters in New York Life Building

By March 20, the A.S.H.V.E. will be housed in its new headquarters on the 31st floor of the New York Life Insurance Building, 61 Madison Avenue, where more commodious quarters have been selected by the Council in order adequately to care for the increasing society activities.

This location at 27th Street is quite convenient to the two railroad terminals, Pennsylvania and Grand Central, as well as to the leading hotels by direct subway connections. In this monumental building on the site of the old Madison Square Garden, the outlook is unobstructed by surrounding buildings, so that ideal working conditions are assured. The equipment and furnishings voted by the Council provide for greater efficiency and a more attractive headquarters office.

The present offices in the Engineering Societies Building are given up to meet the requirements of the growing society after a tenancy of nineteen years. During this time the organization has made great strides, increasing its membership from about 400 to more than 2000.

Better Relations Commission Proposed by Illinois Chapter

Need of better cooperation in the industry through a board or commission to represent the architects, consulting engineers, ventilating contractors, steam fitting contractors and the A. S. H. V. E. was recognized by the Illinois Chapter when, at its January meeting, held January 13, at the Hotel Sherman, Chicago, it voted to appoint a committee to investigate the subject and to report back on the feasibility of such a plan and to outline such a commission's duty, as well as its scope and powers. The matter was presented to the chapter by John Aeberly, chief of the Division of Ventilation, Chicago Department of Health.

The main subject for discussion at the meeting was the ventilating, air conditioning and refrigerating equipment of the Chicago Stadium. E. P. Heckel, of the Carrier Engineering Corporation, was the principal speaker. Among the features of the stadium, to which he called special attention, were the fact that there are 16,300 permanent and 6542 temporary seats in the stadium. The oval floor, 145 x 245 ft., contains 85,000 lin. ft. of 1¼-in. brine piping, through which 1400 gal. of brine circulates per minute. Seven hours are required to cool and 4½ hrs. to spray the floor to make a sheet of ice ½ in. thick.

A proposed reduction in the personnel of the Division of Heating, Ventilating and Industrial Sanitation of the city and, in particular, a reduction of the number of engineers from nine to three, was brought up by President H. G. Thomas. He drew attention to the fact that the city council had voted to retain the nine and he attributed this action largely to the letters of protest which the chapter had sent to the mayor, aldermen and others, supplemented by the personal representations of himslf, Secretary DeLand and Mr. Heckel. Mr. Thomas read letters which the chapter had sent to the mayor and the response from the mayor. He pictured the inevitable slowing up in the industry, which would have resulted if the division had been handicapped by a reduction of its staff in making prompt inspections.

New members elected to the chapter are Fred Lautenschlager, of the Kroeschell Boiler Company, and Daniel B. Scheidecker, of the Hunter Clark Ventilating Company.

Wisconsin Chapter Hears Talk on Stokers

At the January meeting of the Wisconsin Chapter, held at the Milwaukee Elks Club, January 20, E. L. Beckwith, of the Detroit Stoker Company, was the guest speaker of the evening, and gave an interesting discourse on the history, development and adaptability of the stoker in the heating field. He covered all the details of stoker setting under various types of boilers for both high and low-pressure heating, and gave some interesting information on coal and its relation to stoker operation in different localities. Numerous questions were asked the speaker.

A vote was passed to extend an invitation to the society to hold their 1931 summer meeting in Milwaukee under the auspices of the Wisconsin Chapter. President Weimer appointed the following committee to present the invitation at the annual meeting: H. M. Miller, Prof. G. L. Larson, J. S. Jung, C. W. Miller and E. A. Jones.

Homer Linn Addresses Illinois Chapter

The status of oil burners in the heating industry was discussed by Homer Linn at the meeting of the Illinois Chapter, February 10. Mr. Linn gave statistics which showed remarkable growth and apparent stability and permanence of the industry. He reviewed some of the past difficulties and the contributing causes, and also made some excellent recommendations to assist one in making a choice of oil burners.

Following his talk, Harry F. Tapp,

secretary of the American Oil Burner Association, and Byron Eaton, president of the Chicago Oil Burner Association, were introduced.

Other representatives of the oil-burner and oil industry were also present, and with members of this chapter discussed various angles of Mr. Linn's remarks.

H. C. Mueller, of Powers Regulator Company, and D. G. Malone, of Hardin-Lavin Company, were elected to membership.

John Howatt discussed briefly the action at the convention regarding the report on codes for testing and rating steam heating solid fuel boilers, and it was decided to fully discuss the matter at the March meeting.

Cleveland Chapter Hears Talk on School Heating and Ventilating

H. M. Nobis was the principal speaker at the December meeting of the Cleveland Chapter, held in the rooms of the Cleveland Engineering Society, December 13. He presented a paper describing the heating and ventilating of the Allen School at Elyria, O. A description of this installation was published in full in HEATING AND VENTILATING for January.

Philadelphia Chapter Hears Talk on School Heating

J. D. Cassell, superintendent of buildings for the Philadelphia Board of Education, was the principal speaker at the February meeting of the Philadelphia Chapter, held February 12, in the faculty dining room of the Gratz Senior High School. The dinner was served by members of the Philadelphia School Luncheon Dietitians, under the direction of Miss Emma Smedley.

Mr. Cassell described the mechanical equipment of the Gratz Senior High School, explaining that the power plant of this building provides heat not only for the Gratz Senior High School but also for the Gillespie Junior High, which is immediately adjacent. He then gave a comprehensive review of the history of the various types of heating and ventilating systems installed in the Philadelphia schools during the past 40 years.

At the conclusion of his talk, the party inspected the school under the guidance of members of the Board of Education English Department.

Committee chairmen appointed by President Black are as follows:

Meetings	M. F. Blankin
Membership	A. J. Nesbitt
Finance	Lee Nusbaum
Year Book	C. D. Graham
New member of legislative committee to serve for three years	J. D. Cassell

Chairman M. F. Blankin of the Meetings Committee announced that the March meeting would be devoted to a discussion of gas heating.

New Officers for Western New York Chapter

New officers for the Western New York Chapter, elected at the December meeting, are: President, Fletcher Burke; first vice-president, Joseph Davis; second vice-president, Myron Beeman; secretary, David Mahoney; treasurer, Clarence Love. The December meeting of the chapter took the form of a joint meeting with the local section of the A.S.M.E. The party went to Rochester where an inspection was made of the plant of the Stecher Lithographic Company. Particular interest was shown in the heating and air-conditioning equipment, which included three H.R.T. brick-set high-pressure boilers, each rated at 200 H.P. and carrying a pressure of 160 lbs. fired by Combustion Engineering stokers, as well as equipment for supplying 260 tons of refrigeration for air cooling, designed to maintain a uniform humidity of 42%.

After the inspection the party reconvened at the Sagamore Hotel, Rochester, and was addressed by Mr. Fairfax, engineer of the Stecher Lithographic Company. Mr. Fairfax presented a paper covering the story of central steam and power generation for the factory district surrounding the Stecher plant. Following his address a motion picture, presented by the American Illuminating Company, illustrated the effect of patented solutions used in purifying boiler water.

Mr. VanVecten, president of the Stetcher Plant, and Ralph T. Coe, arranged the meeting.

1930 Edition of "Guide" Ready

The eighth edition of the A.S.H.V.E. *Guide* is now off the press and ready for distribution. It contains three new chapters—Heating by Electricity, Specifications and Symbols.

Copies may be obtained from our Book Department, HEATING AND VENTILATING, 521-5th Ave., New York. Price $5.

1927 Transactions of the A. S. H. V. E.

Transactions of the A.S.H.V.E., Volume 33, for 1927, are now available. Among the papers covered in the 1927 transactions are the "Heating Effect of Radiators," by Brabbée; "Comparative Tests of Radiator Finishes," by Severns; "Practical Application of Temperature, Humidity and Air Motion Data to Air Conditioning Problems," by Houghten, Teague and Miller; "Effect of Enclosures on Radiator Performance," by Kratz and Fahnestock. Size 6 in. x 9 in. Pp. 400. Copies may be obtained from our Book Department, HEATING AND VENTILATING, 521—5th Ave., New York. Price $5.

World Engineering Congress Papers

No less than seven papers on subjects connected with heating and ventilating were included in the program of the World Engineering Congress, held in Tokio last fall. In addition to the paper presented by Willis H. Carrier on "Control of Humidity and Temperature as Applied to the Manufacturing Processes and Human Comforts," other papers were:

"The Development of Heating Systems in Japan" by Kunisuke Sekido, in which the author reviewed briefly the different stages of development which Japan has gone through in her heating methods.

"Ventilation of Railway Tunnels," by Ing. Cav. Uff. Efisio Vodret.

"The Trend of Modern Heating in the British Isles," by J. R. Preston.

"New Problems in the Heating Industry," By C. W. Brabbée.

"Train Heating on Electrified Lines," by Ing. Cav. Severo Bissone.

"Ventilation of Vehicular Tunnels" by Ole Singstad.

"A Handbook on Piping"

There are many things which every engineer is assumed to know about piping, but the sources of such information are not always so readily available as to justify this assumption. In designing some piece of work requiring the use of piping, the designer has often been under the necessity of searching through collections of catalogs, handbooks, and even fittings themselves, perhaps without finding the details desired.

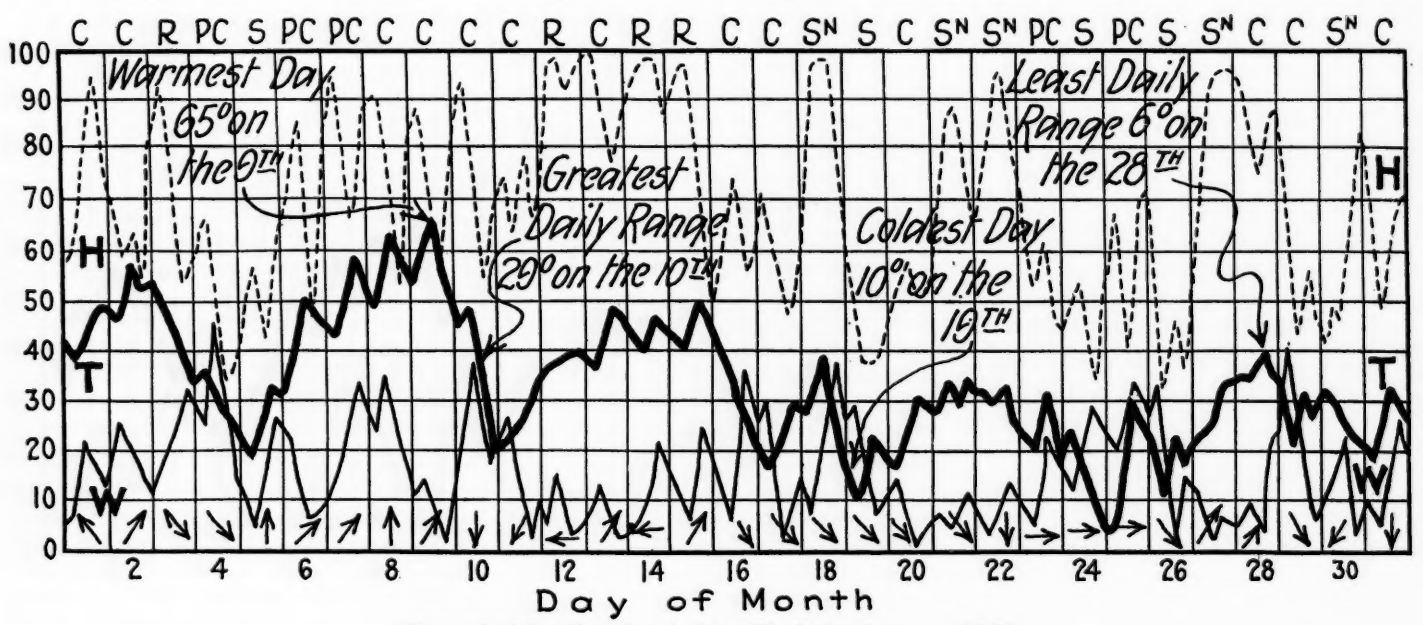
"A Handbook on Piping" by Carl L. Svensen, assistant professor, Ohio State University, is offered for the purpose of supplying in convenient form, information and data regarding piping, fittings, pipe joints, valves, piping drawings, and pipe lines and their accessories.

Among the chapters are those on Dimensions and Strength of Pipe, Pipe Threads, Pipe Fittings, Pipe Joints, Standard and Special Valves, Steam Piping, Exhaust Piping and Condensers, Water Heaters, Piping for Heating Systems, Water and Hydraulic Piping, Erection, Workmanship, Piping Insulation, Drawings and Specifications.

Size 6¼ in. x 9¼ in. Pp. 359, with eight folding plates. Published by D. Van Nostrand Co., New York, or may be secured through our Book Department, HEATING AND VENTILATING, 521 Fifth Avenue. Price $4.

The Weather for January, 1930

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	65	64	63	51	60
Date of highest temperature	9	8	7	6	1
Lowest temperature, deg. F.	10	8	0	—16	—13
Date of lowest temperature	19	17	19	18	18
Greatest daily range, deg. F.	29	26	35	25	28
Date of greatest daily range	10	4	15	14	18
Least daily range, deg. F.	6	5	5	3	3
Date of least daily range	28	14	31	13	8
Mean temperature for month, deg. F.	33.6	31.8	31.8	20.1	24.7
Normal mean temperature for month, deg. F.	30.9	27.9	30.5	23.7	31.1
Total precipitation, this month, inches	2.58	2.77	1.67	2.23	5.70
Total snowfall, this month, inches	4.1	7.7	6.9	14.1	11.0
Normal precipitation, this month, inches	3.66	3.61	3.05	1.90	2.34
Total wind movement, this month, miles	9979	5536	7427	7770	7641
Average hourly wind velocity, miles	13.4	7.4	10.0	10.4	10.3
Prevailing direction of wind	N.W.	N.W.	S.	S.W.	N.W.
Number of clear days	3	7	4	8	13
Number of partly cloudy days	6	7	6	7	3
Number of cloudy days	22	17	21	16	15
Number of days with precipitation	9	11	17	16	12
Number of days with snowfall	5	7	7	12	5
Snow on ground at end of month	0.5	0.8	0.5	3.0	0.4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Warmest Day 65° on the 9TH
Greatest Daily Range 29° on the 10TH
Coldest Day 10° on the 19TH
Least Daily Range 6° on the 28TH
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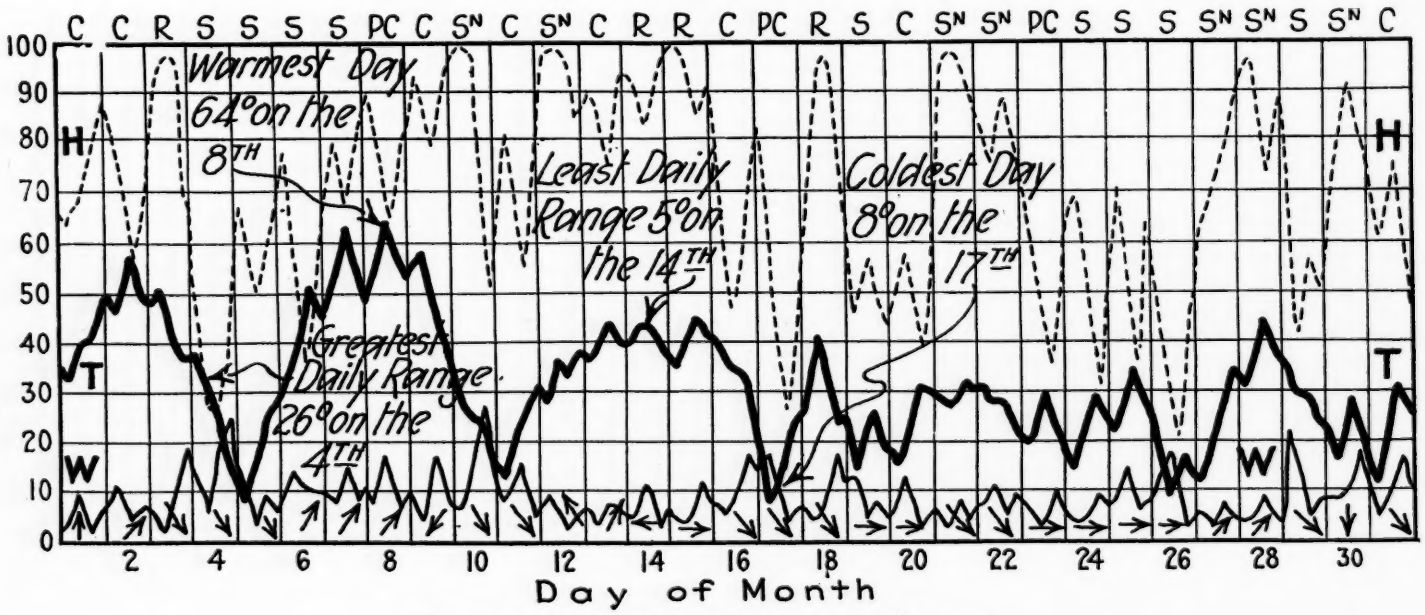
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Record of the Weather in New York for January, 1930
(Hourly Observation of the Relative Humidity Plotted on this Chart)


C C R S S S S PC C SN C SN C R R C PC R S C SN SN PC S S S SN SN S SN C
Warmest Day 64° on the 8TH
Least Daily Range 5° on the 14TH
Coldest Day 8° on the 17TH
Greatest Daily Range 26° on the 4TH
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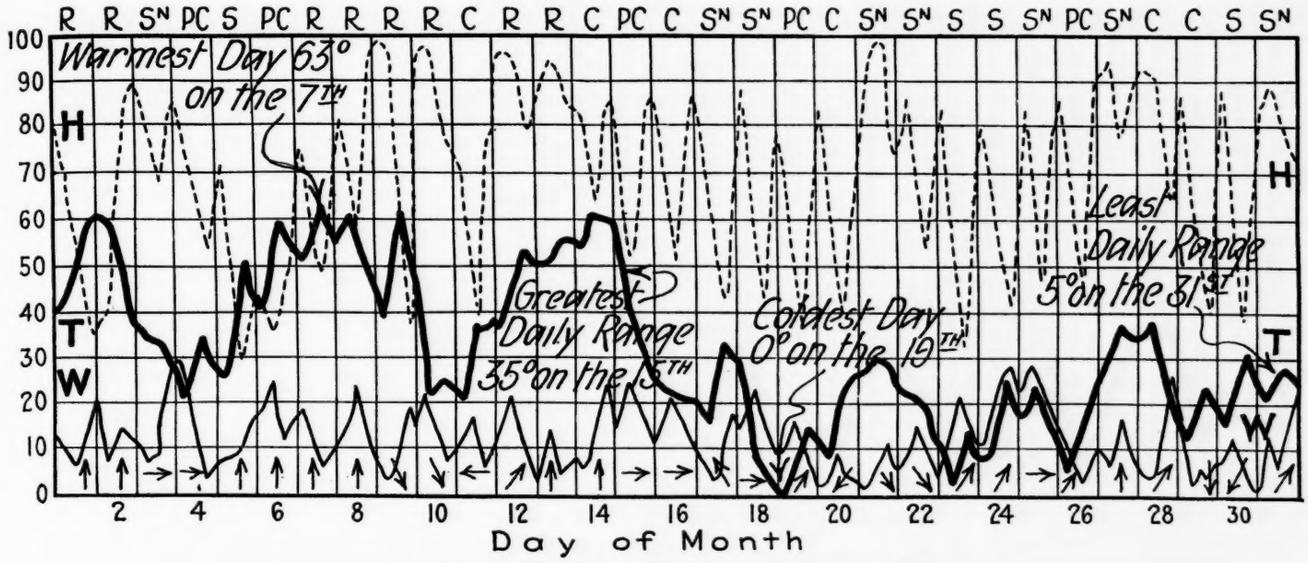
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Record of the Weather in Boston for January, 1930


R R SN PC S PC R R R R C R R C PC C SN SN PC C SN SN S S SN PC SN C C S SN
Warmest Day 63° on the 7TH
Greatest Daily Range 35° on the 5TH
Coldest Day 0° on the 19TH
Least Daily Range 5° on the 31ST
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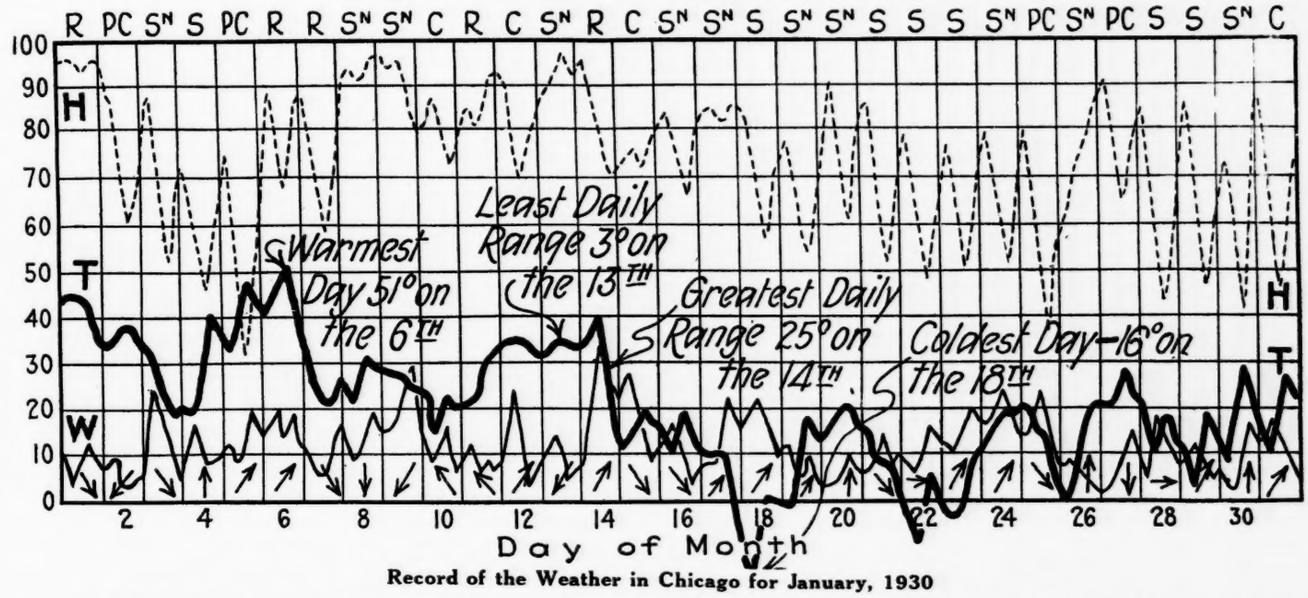
Day of Month

Record of the Weather in Pittsburgh for January, 1930


R PC SN S PC R R SN SN C R C SN R C SN SN S SN SN S S S SN PC SN PC S S SN C
Warmest Day 51° on the 6TH
Least Daily Range 3° on the 13TH
Greatest Daily Range 25° on the 14TH
Coldest Day—16° on the 18TH
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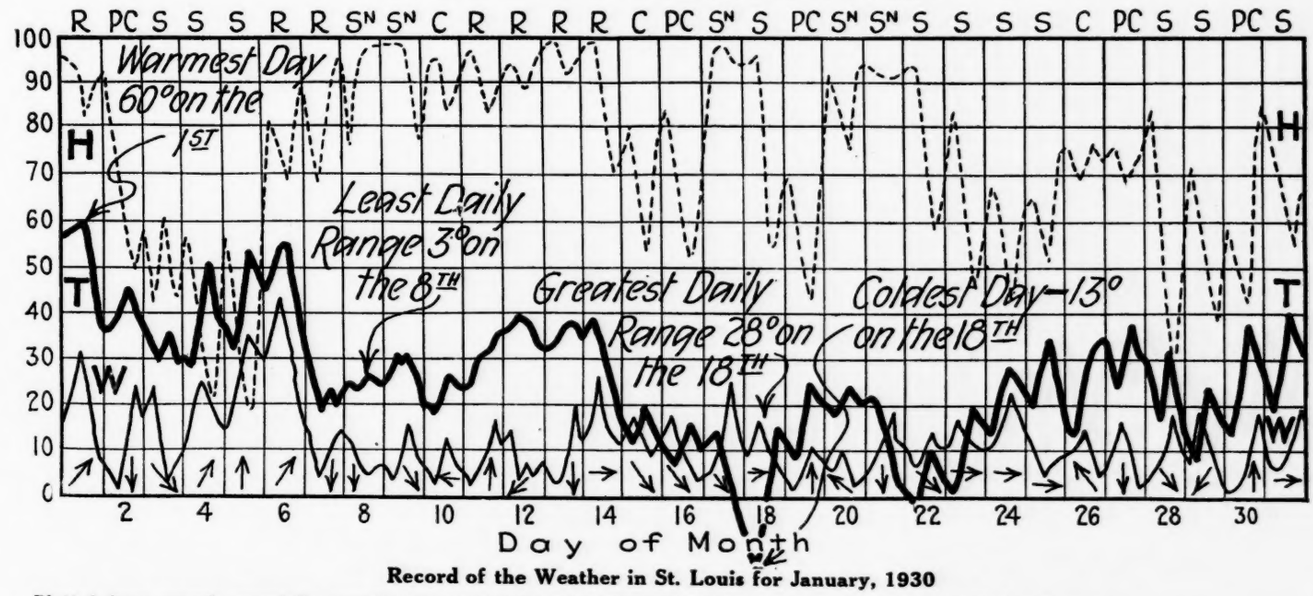
Day of Month

Record of the Weather in Chicago for January, 1930


R PC S S S R R SN SN C R R R R C PC SN S PC SN SN S S S S C PC S S PC S
Warmest Day 60° on the 1ST
Least Daily Range 3° on the 8TH
Greatest Daily Range 28° on the 18TH
Coldest Day—13° on the 18TH
H
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W
Day of Month

Record of the Weather in St. Louis for January, 1930

Plotted from records especially compiled for HEATING AND VENTILATING by the United States Weather Bureau.
Heavy lines indicate temperatures in degree F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A.M., 12 M., and 8 P.M. Arrows fly with prevailing directions of wind.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.

Degree-Days and Unit Fuel Consumption in Typical Cities for January

IN addition to the monthly totals in degree-days presented for these typical cities, the unit fuel consumption for these cities for the month of January is included. The figures are given in pounds of coal, gallons of oil, and cubic feet of gas per square foot of steam radiation for the month of January, calculated on the basis of radiation installed for a zero to 70° temperature difference and an efficiency of 100%.

Corrections must be made for efficiencies, heat content of fuel other than that listed below, for radiation emitting other than 240 B.T.U. per hr., and for radiation calculated on a basis of other than zero to 70°.

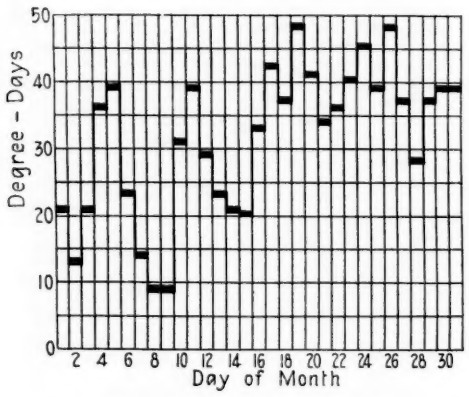
Coal is assumed as having a heat content of 12,000 B.T.U. per lb., gas, 1000 B.T.U. per cu. ft., and oil 140,000 B.T.U. per gal. To correct for other heating values, multiply the fuel consumption listed under the charts by the standard heat content just listed, and divide by the heat content in question.

To correct for efficiency, divide the fuel consumption by the efficiency of the heating installation.

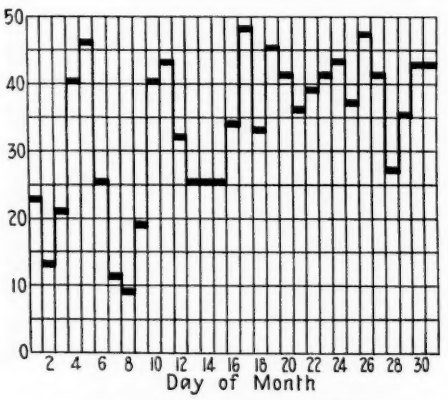
For water radiation, multiply the fuel consumption, which is given for steam radiation, by 5/8.

If fuel consumption is estimated for radiation installed for —10° outside temperature, multiply the fuel consumption by 7/8. If the radiation was calculated for + 10°, multiply by 7/6.

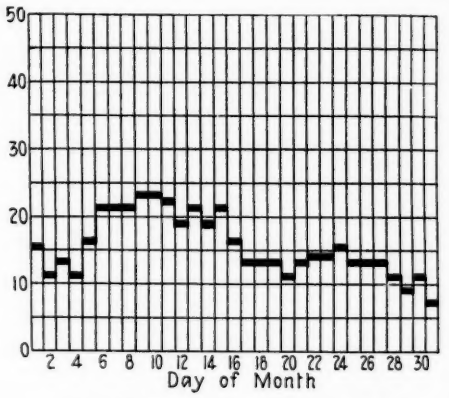
In other words, for radiation installed for any other outside temperatures than zero, multiply the fuel consumption given under the charts by 70°, divided by the quantity (70 minus the outside temperature used).



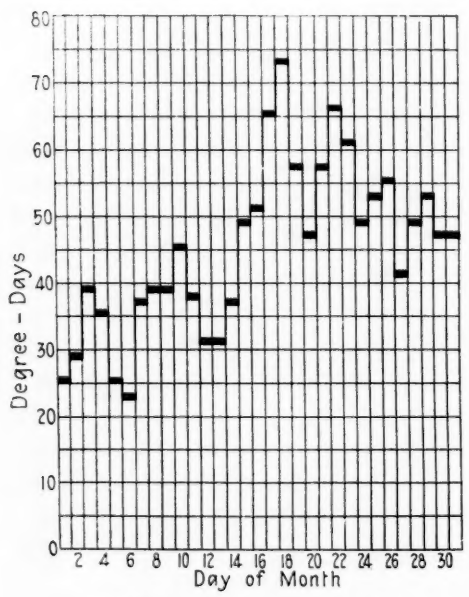
New York, January, 1930
Degree-Days 971—to Date, 2832
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 7.77
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.666
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 93.22
(See Footnote)



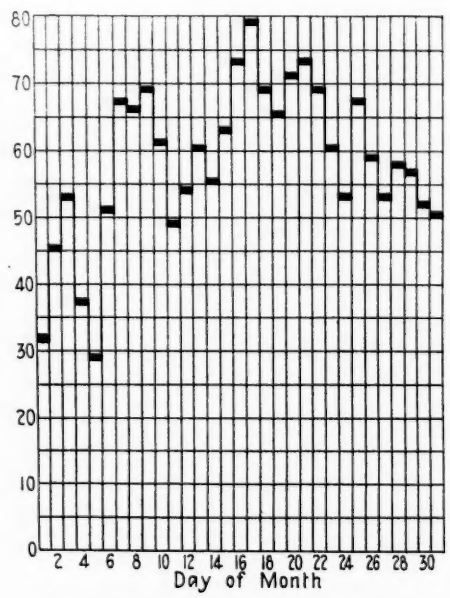
Boston, January, 1930
Degree-Days 1030—to Date, 3121
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 8.24
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.706
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 98.88
(See Footnote)



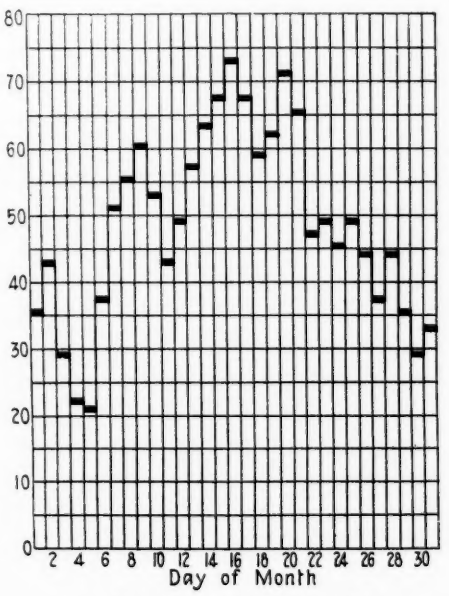
San Francisco, January, 1930
Degree-Days 476—to Date, 1185
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 3.81
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.326
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 45.70
(See Footnote)



Chicago, January, 1930
Degree-Days 1393—to Date, 3854
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 11.14
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.955
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 133.73
(See Footnote)

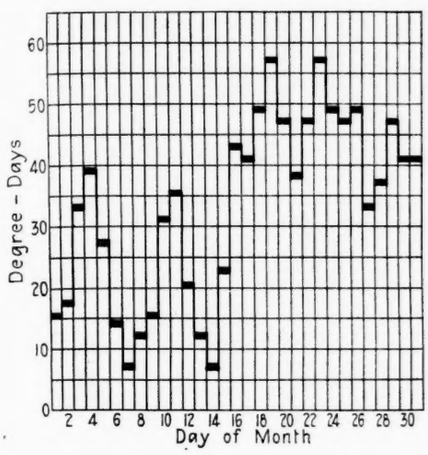


Minneapolis, January, 1930
Degree-Days 1799—to Date, 5056
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 14.39
Gals. of Oil per Sq. Ft. of Radiation for this Month, 1.234
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 172.70
(See Footnote)



Denver, January, 1930
Degree-Days 1494—to Date, 4020
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 11.95
Gals. of Oil per Sq. Ft. of Radiation for this Month, 1.024
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 143.42
(See Footnote)

These figures must be corrected for local conditions as explained above.

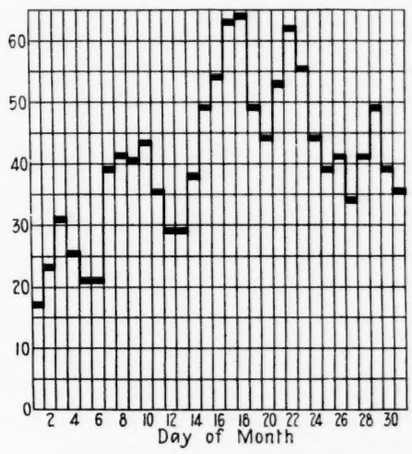


Pittsburgh, January, 1930

Degree-Days 1030—to Date, 3179

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 8.24
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.706
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 98.88

(See Footnote, Page 116)

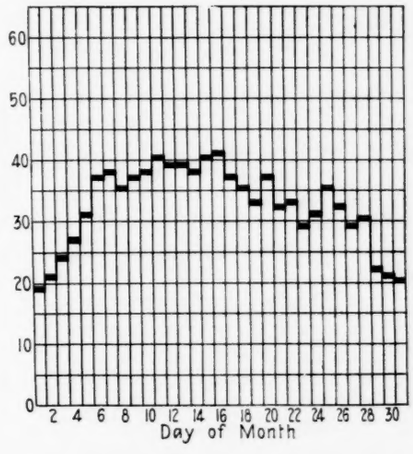


St. Louis, January, 1930

Degree-Days 1247—to Date, 3067

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 9.98
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.855
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 119.71

(See Footnote, Page 116)



Seattle, January, 1930

Degree-Days 1000—to Date, 2701

Lbs. of Coal per Sq. Ft. of Radiation for this Month, 8.00
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.686
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 96.00

(See Footnote, Page 116)

	Los Angeles	Baltimore	Philadelphia	New Orleans	Atlanta	Cleveland	Cincinnati	Detroit
Degree-Days	285	893	906	402	689	1159	1062	1307
Lbs. of Coal per Sq. Ft. of Radiation for January, 1930	2.28	7.14	7.25	3.22	5.51	9.27	8.50	10.46
Gals. of Oil per Sq. Ft. of Radiation for January, 1930	0.195	0.612	0.621	0.276	0.472	0.795	0.728	0.896
Cu. Ft. of Gas per Sq. Ft. of Radiation for January, 1930	27.36	85.73	86.98	38.59	66.14	111.26	101.59	125.47

(See Footnote, Page 116)

Death of J. A. Quinn

John A. Quinn, president of the National Association of Master Plumbers, died of pernicious anemia, at his home in Frankford, Philadelphia, Pa., January 24, at the age of 54. Last October, even though his health was failing, Mr. Quinn refused to depart from the program of association work he had set for himself, and later his friends remonstrated that he was working too hard, but he dismissed the idea. But finally he had to give up his work and National Secretary Maney Feeney represented him at the various trade gatherings.

Mr. Quinn was an energetic and tireless worker for the association and eight years ago he gained prominence when he urged the association to give more attention to the problems of apprenticeship to provide means for educating the young men who enter the plumbing business. As the result of his efforts, the national association appointed an apprenticeship committee, of which Mr. Quinn was chairman, and he held this post until 1928, when he was elected vice-president of the association at the Memphis convention.

At the time Mr. Quinn launched his educational work there were practically no schools for apprentices. Today there are more than 130 where plumbing is taught, and these have a total enrollment of over 7000 apprentices and 3000 journeymen.

Charles E. Hall

Charles Edward Hall, widely-known hardware merchant, and president of the Hall-Neal Furnace Company, in Indianapolis, Ind., died recently after an illness of four months, at the age of 56. In 1891 he entered the employ of a bank in Indianapolis and later went into the hardware business, becoming president of the Hall Hardware Company until the organization of the Hall-Neal Furnace Company. For ten years he served as president of that concern until his death, and also was treasurer of the Indiana Retail Hardware Association for twenty years.

Mr. Hall had been president of the National Warm-Air Heating Association, and a member of the board of governors of the Indianapolis Board of Trade.

Francis J. Oliver

Francis J. Oliver, president and treasurer of Oliver Bros., New York, died suddenly of a heart attack at his home in Hackensack, N. J., February 7. Mr. Oliver was 67 years of age at the time of his death.

Thomas Shipley

Thomas Shipley, president and general manager of the York Ice Machinery Corporation, died at his home in York, Pa., January 22, at the age of 69. Mr. Shipley who graduated from Cooper Institute in New York, in 1881, has been identified with the refrigerating industry since 1884, when he joined the firm of Wood and Shipley, ice machinery manufacturers. A few years later he went to Waynesboro, Pa., to become associated with the Frick Company, in refrigerating engineering. In 1892, he left Waynesboro and was engaged in the operation of two ice plants, one in Steubenville and one in Pittsburgh. Three years later he returned to the Frick Company and became manager of the ice machinery and refrigeration department. In 1897, he went to York to become general manager of the York Machinery Company, and in 1927, when leading manufacturers of ice machinery in the United States were merged with the York company, and the York Ice Machinery Corporation was formed, he became president and general manager of the consolidation, serving in this capacity until the time of his death.

Mr. Shipley did a great deal of research work in the standardization of equipment and the setting up of a standard or unit ton of refrigeration.

Eastern Supply Discusses Trade Practice Rules

An outstanding feature of the Eastern Supply Association meeting held in New York, February 12-13, was the interest shown in the trade practice rules established last year. F. W. Swanson, president and commissioner of the National Plumbing and Heating Institute, discussed the relationship of the institute with the trade practice rules. He pointed out carefully that while the institute can rigidly supervise the rules, the effectiveness depends on the support of the members.

F. S. Jefferies, secretary of the Illinois Credit Bureau, stated that 30% of plumbing accounts require over 60 days to settle bills, while 70% of the heating accounts run beyond that period.

A plea for an understanding on the part of the jobber of the profit he is making in the various lines, was made by Lorin W. Smith, Jr., of the Minneapolis-Honeywell Regulator Company. Mr. Smith reported a survey his company had made of jobbers, and stated that they reported much higher profits in all lines than they actually are making. An analysis of the survey, Mr. Smith pointed out, suggests more careful merchandising and a better knowledge of cost accounting than has been customary in the past.

New York Contractors Will Meet in Albany

Heating and Piping Contractors New York State Association will hold its thirty-fifth annual convention in Albany, New York, March 10-11, 1930, with headquarters at The Ten Eyck.

William J. Olvany, of New York, president of the association, predicts that this meeting will be one of the best attended and most profitable conventions ever held by the heating trade in New York State, and calls attention to the fact that during the past year the membership of the New York State Association had increased 30%.

E. W. Tompkins, president of the Capital District Association, announces that the Capital District Association joins the New York State Association in inviting every one interested in the heating industry to attend this meeting.

Cleveland Association Elects Officers

The Heating and Piping Contractors Cleveland Association held its annual election of officers at a recent meeting at the Hotel Statler: President, E. L. Heinle; vice-president, E. Maurer; secretary, Adolph Weiss, and treasurer, W. R. Rhoton.

Board of directors: A. C. Banko, W. F. Hann, George Spohn, R. W. Mayer, Charles Holmes and C. W. Neitzel.

Contractors Organize Western Conference

Twenty western members of the Heating and Piping Contractors National Association recently met in San Francisco, Calif., at the St. Francis Hotel, and formed the Western States Conference. The aim of the conference is a closer concert of effort and a more intimate contact in the solution of their particular problems.

Officers elected were: President, A. G. Atwood, of San Francisco; secretary-treasurer, Thomas C. Douglass, of San Francisco; vice-presidents, B. E. Rose, Seattle; W. M. Lucas, Spokane; Eugene Rudey, Portland; A. O. Reed, San Diego; Frank Hudson, Fresno; John Hawley, Sacramento, and Charles W. Gould of Tucson.

It was decided to hold regular semi-annual meetings, and it also was voted to invite the national association to hold its 1931 convention in San Francisco.

Home Building Show's Heating and Ventilating Committee

An organization meeting of the heating and ventilating committee to cooperate with the Home Building Show to be held at the Grand Central Palace, New York, March 31 to April 5 next, was held January 17, at the headquarters of the A. S. H. V. E. E. J. Ritchie, president of the New York Chapter of the society, was elected chairman, the other members being Dr. A. A. Adler, M. E. Durkee, A. V. Hutchinson, W. H. Hyman, Alfred J. Offner, Harry Tapp, A. S. Armagnac, George Schmidt, R. A. Wolff, H. B. Hedges, R. H. Carpenter, G. V. Christie, A. P. Mudgett, A. E. Hanson and J. B. Garfield.

On motion of Doctor Adler, it was voted to include sanitation in the field covered by the committee, so that hereafter the committee will be known as the Heating, Ventilating and Sanitation Committee of the Home Building Show. It was further voted to extend an invitation to the chief sanitary engineer of New York to serve on the committee.

In a discussion concerning new features for the exposition, it was the consensus of opinion that a strong effort should be made to secure exhibits of the humidified air type of equipment.

It was further proposed to enlist the support of the A. S. H. V. E. in acting as sponsor for both the New York and Chicago Home Building Shows.

1930 Program of Plumbing and Heating Industries Bureau

The Plumbing and Heating Industries Bureau, with its 1930 officers elected, its proposed budget approved, and its program of activities set, has declared itself ready to go ahead. George H. Drake, Buffalo, president of the National Association of Master Plumbers, succeeding John A. Quinn, deceased, was elected president of the bureau; Harry M. Hart, Chicago, vice-president; John Kohler, treasurer, and E. L. Flentje continues as secretary-manager.

The directors endorsed the 1930 program as outlined by Mr. Flentje, asking for concentration on the following major problems which are confronting the industries: 1—Direct selling competition; 2—national credit policies, and 3—merchandising activities.

National Plumbers' Convention and Exposition to be Held in Boston

In connection with the forthcoming National Plumbers' Convention and Exposition, to be held in the Mechanics Building, Boston, from June 23-26, 1930, the committee in charge have opened offices at the 328 Nottingham Bldg., 25 Huntington Ave., Boston. The committee, of which F. W. Donoghue is chairman, will prepare the floor plan and other specific data for the use of exhibitors at the exposition. According to the tentative plans of the committee, about 85,000 sq. ft. of floor space will be used, of which about 50,000 sq. ft. will be used for exhibiting purposes, and the balance for the convention.

An important program is being planned by the special educational committee, headed by C. W. Wanger, of Philadelphia.

Sears, Roebuck & Company Will Build Homes

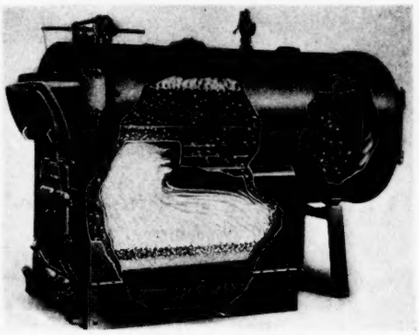
A nation-wide home financing and building plan involving construction this year of $100,000,000 in homes for the small investor has been undertaken by Sears, Roebuck & Company.

This company will not only finance the building, but will do the actual construction work, including heating, plumbing and wiring. Those purchasing a house under this plan will have 15 years in which to pay for it, and the company will lend up to $3 for every dollar invested by the owner of the house and lot. In addition to the new home building, the company will supply materials, finance the remodeling of old houses and modernize them.

New Apparatus and Appliances

Fitzgibbons Z U Firebox Boiler

The Z U steel firebox boiler has been announced by Fitzgibbons Boiler Co., Inc., 570 Seventh Ave., New York. A particular feature of the boiler is that



Fitzgibbons ZU Firebox Boiler Up-draft Type

the fire tube cylinder extends into the firebox. The curved bottom of the cylinder with the gas arches on each side act as a baffle against which the gases mushroom toward the sides of the firebox and roll forward, turning upward against the front wall and converging at the point where secondary air is admitted.

It is claimed that full benefit of the radiant heat from the coal is secured because of the added percentage of primary or direct heating surface, as compared with the usual steel boiler, and also due to the unusually large area of the water walls surrounding the combustion chamber.

Water walls form the firebox. The rear wall and low part of the side walls are fitted to the fire tube cylinder and are open to the circulation in the lower part of the cylinder. The front wall and high part of the side walls are fitted to the upper fire tube extension and are open to the circulation in the upper part of the cylinder.

Type Z U boilers are built in three types: Smokeless type, for burning soft coal smokelessly; up-draft type, for burning medium and larger sizes of anthracite and bituminous coals and coke, or the buckwheat sizes of anthracite, and the oil, gas, stoker type, for burning hard and soft coals with mechanical stokers or for oil or gas firing.

These boilers are available in 20 sizes, in each of the three types, for either steam or hot water, with capacities ranging from 4,000 to 39,000 sq. ft. of steam radiation.

Gorton Vaportrap

Designed especially for the Gorton single pipe vapor heating system, the Gorton Vaportrap has been announced by the Gorton Heating Corp., 96 Liberty St., New York.

The Vaportrap is furnished only in connection with this company's single pipe vapor system. The expansive operating member is made of a special non-corrosive thermo metal sensitive to heat. One end is fastened to the top of the valve body and the other end is loose, allowing it to move freely up or down as it expands and contracts.

Vaportrap for Gorton Single Pipe Vapor System

When vapor enters the trap, the heat causes the metal to expand, moving the loose end up and closing the valve and holding it closed against the escape of vapor. The large space around the float and the large opening between the upper and lower part of the trap insures drainage and prevents water logging.

The trap is attached in the bottom 1½-in. tapping of the radiator at the end opposite the supply valve.

ParkSpray Unit Air Conditioner

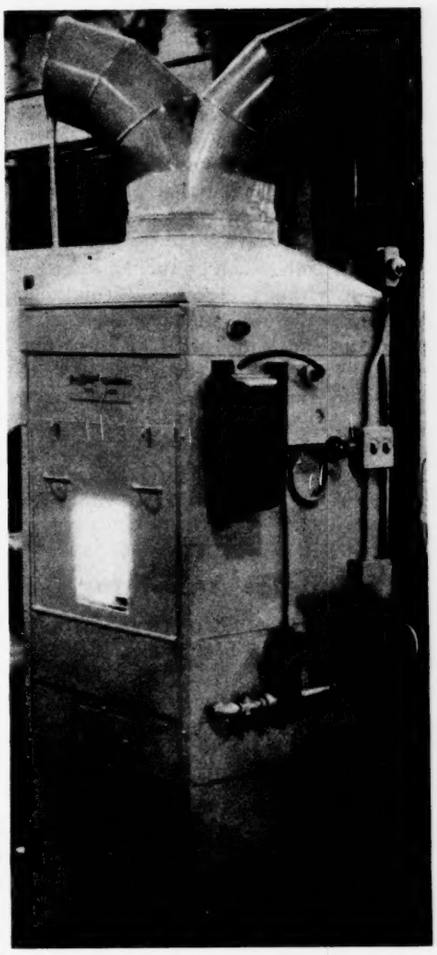
A unit air conditioner Type NCH of compact design is announced by the Parks-Cramer Co., Fitchburg, Mass. The total power required is 290 watts. The unit handles 1500 cu. ft. of air per minute and will evaporate up to 4 gal. of water per hr.

An immersion heater, thermostatically controlled, holds the water at any desired temperature. The air, after passing through the humidifying chamber, is warmed by an extended surface heater, also thermostatically controlled by a sensitive element placed anywhere in the room. The new ParkSpray Hygrostat controls the humidity of the air. The unit is supplied with or without any of these supplementary devices at the option of the customer.

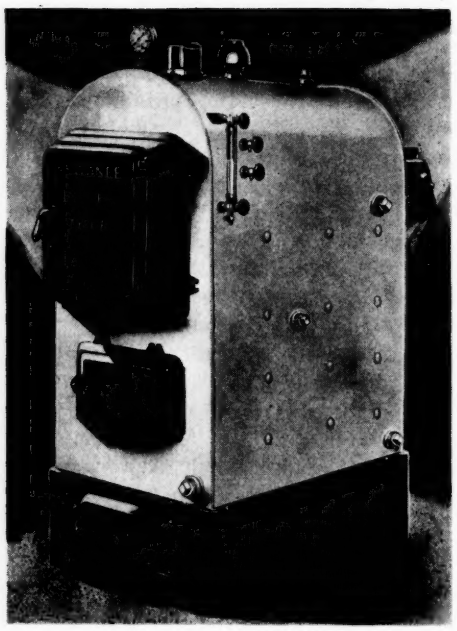
The humidifying unit is of the centrifugal type. Water is thrown off by a rapidly revolving disc in a very fine spray and circulated throughout the room by a multi-blade fan mounted on the same shaft as the disc. Eliminator plates remove all the free moisture, allowing only the saturated air to pass through.

Designed for laboratories, testing rooms, conditioning rooms, and small manufacturing spaces, the unit is quiet in operation, and can be used in offices. It will produce a decided cooling effect during the hot summer weather.

The unit can either be placed in the room or located outside the room and connected to it with supply and return air ducts.



ParkSpray Unit Air Conditioner



Kewanee Residence Type R Boiler

Kewanee Residence Boiler

Designed to serve small buildings, such as garages, residences, stores, schools and churches, the Type R steel boiler has been announced by the Kewanee Boiler Corp., Kewanee, Ill. The boiler will burn any kind of solid fuel, including coke and briquette and also any liquid fuel oil, or natural and manufactured gas.

The firebox is made in one piece with the rear combustion chamber where fuel is ignited first, following which the burning process is completed before the products of combustion are drawn through the bank of the first pass tubular flues.

Type R boilers can be furnished either with or without jackets. Bituminous-burning boilers are made in eight sizes for steam and water, with steam ratings ranging from 370 to 1960 sq. ft. of radiation; anthracite boilers in eight sizes with steam radiations ranging from 430 to 1960 sq. ft., and oil-burning boilers in eight sizes, with steam ratings ranging from 450 to 2380 sq. ft. of radiation.

Model A Aqualator

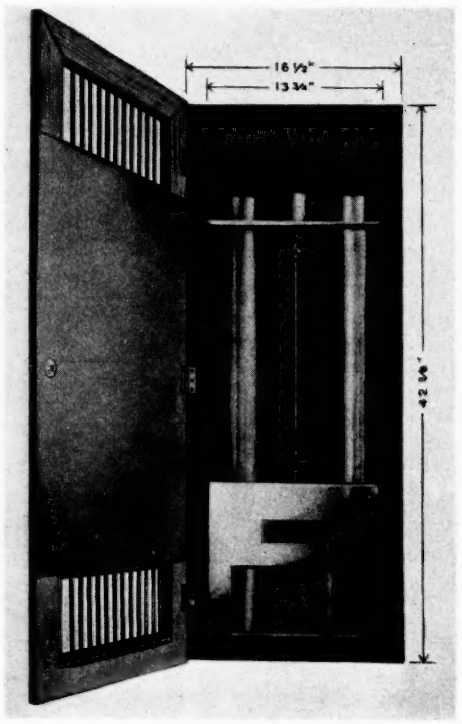
A humidifying device to be installed on an inside wall in a home, known as the Model A Aqulator, has been announced by the Aqualator Division, The Wilcolator Co., 17 Nevada St., Newark, New Jersey.

Water is sprayed downward through two copper tubes, causing air to be drawn into each tube by the suction thus created, the sprays acting like pistons. The air is saturated with water vapor during the process, and is emitted into the room. The complete spray-head assembly, consisting of the two nozzles and filter, can be easily removed for cleaning by loosening the union below the filter. The humidifying member is made entirely of copper and brass, and is supported by an angle iron frame, removable.

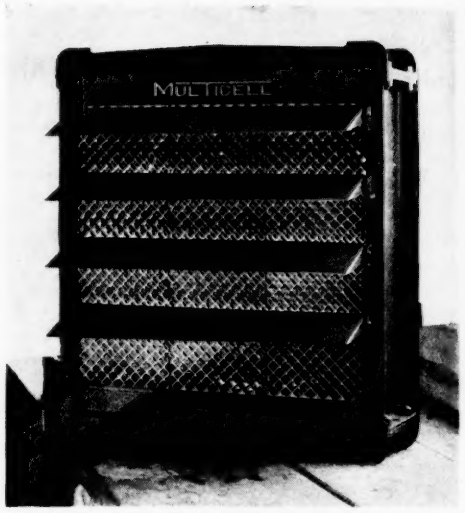
Connections required are a ½ in. feed pipe which should be of brass, which is connected to an indirect water heater at the boiler, and a ¾ in. drain pipe which should be led to an open drain. A pressure equalizing shower mixing valve may be used if preferred to secure tempered water.

The device will fit between the joists, and is equipped with a mirror frame in antique gold metal leaf. Other finishes and designs can be supplied on special orders. The Aqulator is controlled by means of a petcock accessible by opening the mirror frame door.

One Aqualator will evaporate from 12 to 15 gal. of water per day.



Inside of Aqualator for Humidifying Homes



Multicell Unit Heater

Unit Heater of One-Piece Copper

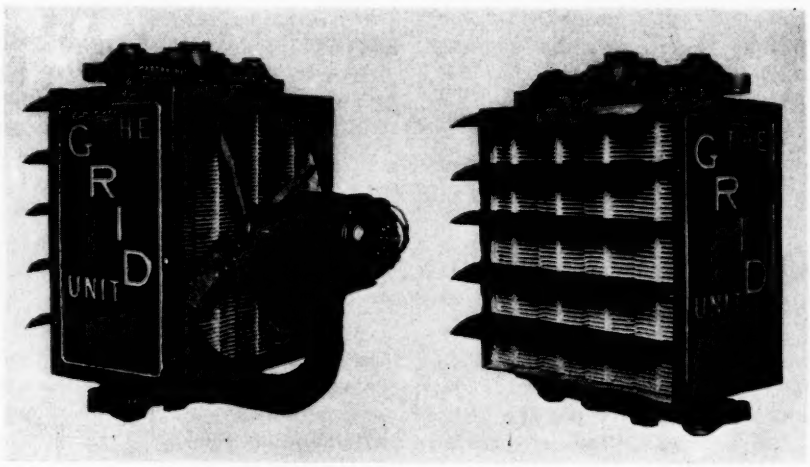
A unit heater of unique design has been introduced by the Multicell Radiator Corp., Lockport, N. Y.

Heating surface is comprised of removable sections of cellular design and of one-piece seamless copper construction. Their accordion-like pattern permits the sections to expand and contract within themselves thus eliminating the necessity of special mounting to compensate for expansion and contraction strains. The sections are mounted in a rigid all-cast frame by means of compression unions at top and bottom.

Multicell unit heaters employ no fin surface. All air passing through these unit heaters is broken up into a large number of small streams bringing each particle intimately in contact with all prime heating surface.

Suspended Unit for Heating and Cooling

Known as the Grid Unit, a suspended type unit heater has been placed on the market by the Unit Heater and Cooler Co., Wausau, Wis. The units are adapted

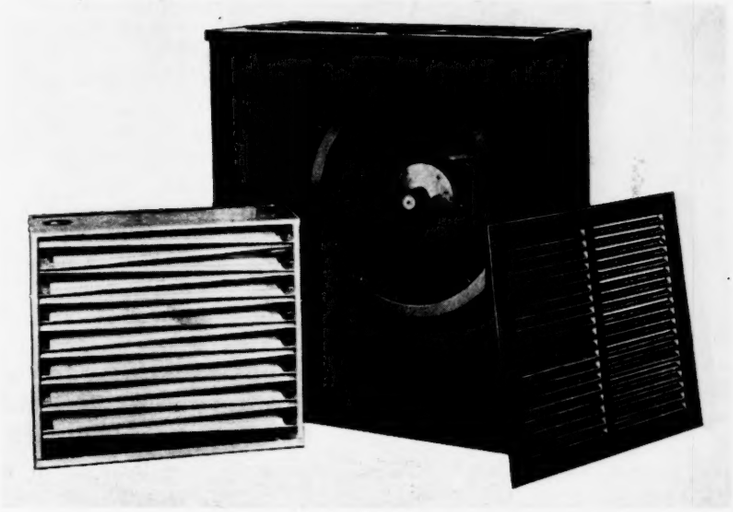


Grid Unit for Heating and Cooling

for the circulation of cold water, sodium or calcium brine, by direct connection to refrigerant pipe lines, as well as to steam lines, so that the unit can be used for cooling as well as heating.

Heating elements are composed of composite castings of close grained gray iron and aluminum alloy. They are of the cast, extended surface, light alloy type, and are guaranteed for a working pressure of 250 lb. gauge. Manifolds are gray iron castings with lugs for attaching supporting rods, while the casing or cabinet is made of pressed sheet steel, attached to the manifold. Louvres are attached to the casing with special spring washers and bolts to permit holding them in any desired position.

Grid Units are made in four models, with capacities ranging from 76,000 to 382,000 B.T.U. per hr. at 5 lbs. pressure, and entering air at 60°, equivalent to 317 sq. ft. to 1590 sq. ft. of radiation.

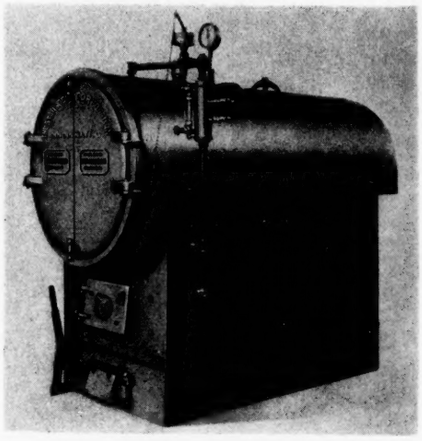


Korectaire Unit Ventilator

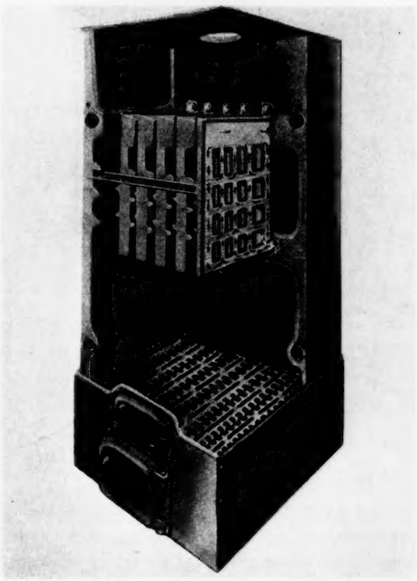
Stanwood Welded Steel Heating Boiler

An electrically-welded steel heating boiler for low pressures was recently announced by the Stanwood Corp., Cincinnati, O. Incorporated in the design and construction are the following features: The shell is made in one complete cylinder, extended at the front end to form the smokebox and perforated at the top of the water legs to insure free water circulation. The rear combustion chamber is made in the shape of a circular arch, allowing sediment to be deposited in the bottom of the water legs where it may easily be blown off instead of accumulating upon the top surface of the arch. Brass plugs for washout are placed in four corners. Cleanout doors are provided in both sides of rear smokebox, also in rear of base. All flues are cleaned from front end.

This line of boilers is made for hand or stoker-firing of coal, oil or gas.



Stanwood Welded Heating Boiler



Section of Jones Curling Flame Boiler

Curling Flame Boilers

A boiler which gives a stack temperature under 350° and will produce steam in less than 5 min. from water at 40°, is claimed for the Curling Flame line of boilers, produced by the Jones Hollow Ware Co., Baltimore, Md.

The boiler is especially designed for and is most efficient with oil. It has very thin vertical tubes in the heating elements, while the rear section holds a large amount of water and acts as a reservoir, keeping the tubes filled properly. The boiler is named the Curling Flame due to the shape of the products of combustion when passing between the heating surface.

The boilers are jacketed and can be supplied in capacities ranging from 500 to 16,500 sq. ft. of steam radiation.

Korectaire Conditioning Unit

A unit designed to circulate, humidify and clean the air has been announced by the Watt Mfg. Co., Sterling, Ill.

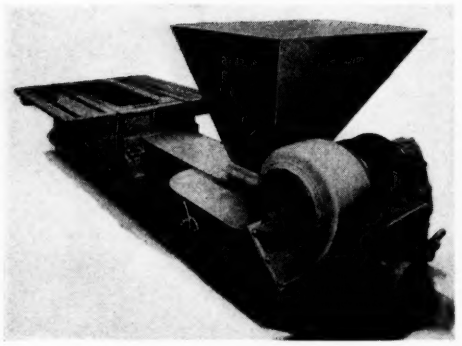
In connection with the fan which gives forced circulation of the air, there is provided a humidifying and cleaning unit made up of a series of corrugated plates covered with absorbent material. Each plate is placed in an inclined position and each alternating plate is in reverse incline to the adjoining one so that the water must travel over the entire system before being discharged.

Air is drawn over the moist plates by the action of the fan, thereby moistening and cleaning the air. The air is cleaned by the particles of dust being attracted to the plates. Soot and fine dust are collected on the under side of the plates while lints and materials of that kind collect on the upper side. The unit is easily cleaned by turning it with the side down over sewer drain and flush with volume of water without nozzle on hose.

By placing a number of humidifying units in tandem and flushing the plates with refrigerated water, the air is definitely cooled.

Redsquare Sectional Boiler

A 17-in. sectional boiler has been announced by the Dunkirk Radiator Corp., Dunkirk, N. Y. The boiler is covered with a porcelain-enameled jacket insulated to prevent heat loss, and has special grates which permit the use of buckwheat coal. The jacket is finished in red enamel with black and brass trimmings. These boilers are available in six sizes in either steam or water types, with capacities ranging from 400 to 1275 sq. ft. of steam radiation.



C-E Fire Tender Stoker

C-E Fire-Tender Stoker

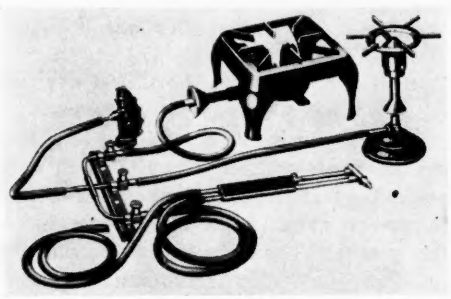
C-E Fire-Tender stokers are being manufactured by Combustion Engineering Corp., 200 Madison Ave., New York. The Fire-Tender is a junior size underfeed unit that can be applied to practically any standard make of heating or power boiler in sizes from 100 to 1000 sq. ft. of heating surface. It is readily installed under existing boilers where hand-fired grates are to be replaced by a mechanical stoker. When applied to existing boilers, the original boiler front and firing doors need not be disturbed, it being only necessary to provide enough clearance space below the existing dead plate to get the lower part of the stoker under.

It is an electrically operated, self-contained unit, consisting, in the main, of a large coal hopper, a conveyor screw, a motor drive, a variable speed gear, a forced-draft fan, air admitting tuyeres, and dead plates. Its fuel-feeding capacity is 50% in excess of maximum rated fuel-burning capacity. The stoker body is self-supporting and is entirely independent of furnace brickwork. It is shipped completely assembled ready for installation.

Hot Plate for Laboratory

A convenient and complete laboratory installation for a source of heat for experimental work is embodied in a recent laboratory test announced by the Prest-O-Lite Company, division of the Union Carbide and Carbon Corp., New York.

The unit consists of a small tank of dissolved acetylene; a hot plate; a Bunsen burner; an acetylene-and-air torch with air control; a reducing valve; a three-way branch valve, and necessary tubing.

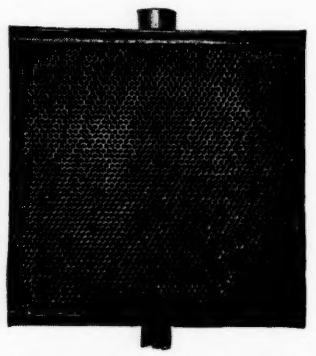


Hot Plate for Laboratory

A special type of torch has been developed for test work, using compressed air in addition to dissolved acetylene. The flame can be changed from the brush type to an intense needle point by adjusting the air supply. This is accomplished by a twist of the adjusting screw. The brush, or Bunsen flame, has a temperature of 2800° F., and the needle point a temperature of 3300° F.

Improved Methods in the Manufacture of Winchester Copper Radiators

One of the most interesting processes in the manufacture of Winchester copper radiators is the extrusion of the tubes from small copper blanks. This process proved the center of attraction when the members and guests of the A. S. H. V. E. inspected the Radiator Division of the Winchester Repeating Arms Company, now located at New Haven, Conn., during the annual meeting in Boston a few years ago.



Winchester Heating Surface

Realizing that the extrusion of these tubes is an extremely delicate process, involving careful consideration of temper, dimensions and speed of operation, the company has taken great pains to perfect its manufacturing process so as to eliminate any possible defect, such as flaws in the tubes themselves, due to hard spots which set up strains, resulting in incipient cracks.

Among the means adopted to prevent defects of this kind is a simple, automatic and effective testing equipment, which tests every individual completed tube for tightness by applying air pressure inside the tube.

Another point on which attention has been centered is that of eliminating the possibility of leaks at the soldered joints between the tubes. Not only has the company utilized a special bonding alloy, developed in its own laboratory, but has adopted improved methods for its application.

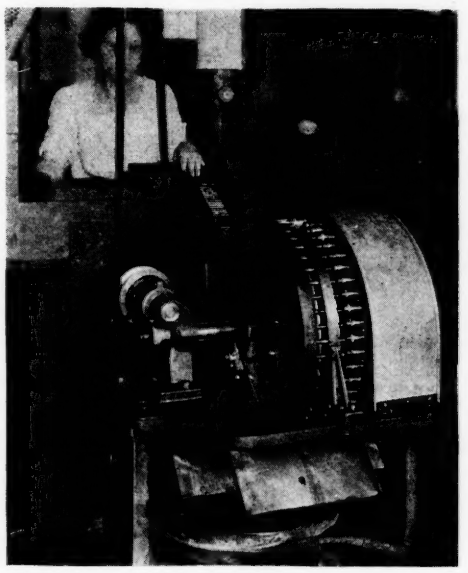
Improved methods have been applied in the construction of the assembled core by bracing the corners of the cores and in attaching the top and bottom tanks. These and other important modifications have been made in order to insure the dependability in service of the present design of construction.

In the design of the Winchester copper radiator, every square foot of the area is prime radiating surface. The thermal efficiency of the material used is always at the highest point because the temperature difference between the metal and the air is at its maximum. In addition to the fact that this construction permits of prime surface, the saving of weight is featured as another important consideration.

High speed of the issuing air blast is easy to obtain in the Winchester tubes as there are no direct baffles interposed in the path of the air, nor is there any deflection from the air's straight course. This condition results from passing the air parallel to the axes of the tubes, instead of perpendicularly, as ordinarily is done. In short, the only factor in determining the speed of the air passing through the radiator is the friction against the walls of the tubes. In this connection, it is interesting to notice that 62% of the frontal area of the Winchester core is free air area.

Because the Winchester core construction presents a steam space, the passages of which are in multiple over two dimensions instead of in multiple over one dimension, the point is made that it is extremely difficult to stop the flow of steam through its interior. Even though the core should become foul with accumulated dirt, its efficiency is not greatly impaired.

The tubes are guaranteed not to burst if the radiator should freeze. In case of freezing, ice forms on the outside of the tubes and has a tendency to crush rather than to split the tubes, in which event the radiator would still function.



Machine for Testing Tubes of Winchester Copper Radiators

Winchester copper radiators are furnished in sizes from 12 in. x 12 in. up to 40 in. x 40 in. and in standard depths of 3 in., 3⅞ in. and 5 in. Full data tables are published by the manufacturer for both "draw through" and "blow through" operation and for velocities ranging from 400 to 1600 ft. per min.

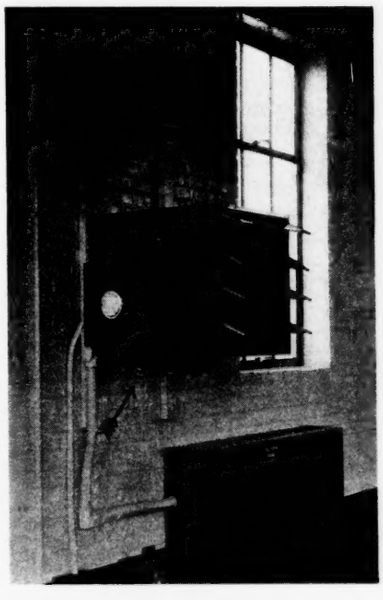
Hynes Electric Heating System

Fan circulation of warm air with automatic control is provided in the Hynes electric heating systems, manufactured by Lee P. Hynes, 240 Cherry St., Philadelphia, Pa. They are especially adapted for heating isolated power houses, substations, depots, storage rooms, garages, pump houses, and industrial buildings where steam is not readily available.

The heating elements are arranged in a heating chamber so that air is forced over them by a motor-driven fan. Warmed air is delivered from the front or bottom of the heater through adjustable louvres.

The system of automatic condensation control reacts to both indoor temperatures and outdoor weather conditions, preventing condensation on walls and equipment due to sudden weather changes, and does this with what is claimed to be a great saving in heat over ordinary thermostatic control methods.

Hynes heaters are made in several standard sizes, with ratings ranging from 5 to 50 K.W., equivalent to 17,000 to 171,000 B.T.U. per hr. capacity. Larger units are available when required.



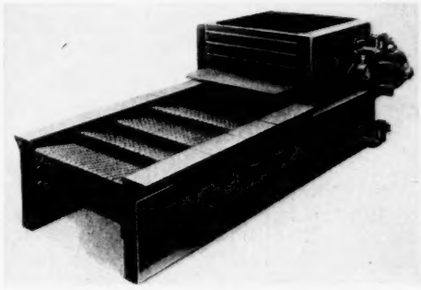
Hynes Electric Heating System in Pump House

Whiting Stoker

Whiting stokers are available in 62 sizes to fit standard boilers from 25 to 250 H.P., the widths ranging from 2 ft. to 6 ft., and the lengths from 3 ft. 6 in. to 6 ft. They are manufactured by the Whiting Corp., Harvey, Ill.

The Whiting stoker is a horizontal feed mechanism, having two stationary and two movable grate sections, each made up of a number of small bars. These sections are inclined, so that the movement of the fuel bed is horizontal, gravity playing no part in the advancement of the fuel bed.

Movable sections have a reciprocating action which feeds the coal from the hopper and advances the fuel bed, affording a uniform feed. The action also provides a certain disturbance for the coal so that caking is impossible and the fire bed is thoroughly aerated.



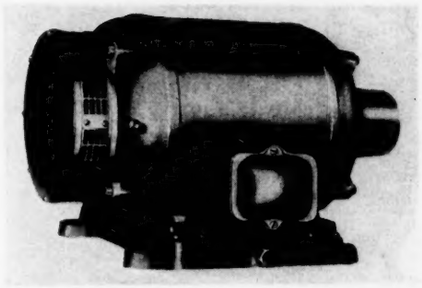
Whiting Low-Set Stoker Assembly of Grate Surface and Side Frame

After the fuel has traveled from the hopper to the rear of the grate, it falls to the ash pit. Ashes are withdrawn from the pit by swinging open the door with operating mechanism and raising a partition, or where possible, through a door located at the side of the boiler.

There are only three moving parts, each supported by roller bearings. To provide control, the movement of the grates is adjustable. The manufacturers claim that the minimum of setting height is required for this stoker. It was developed under the supervision of Joseph Harrington.

Century Enclosed Motor

A line of totally-enclosed, fan-cooled squirrel cage induction motors is announced by the Century Electric Co., 1806 Pine St., St. Louis, Mo. These motors have the size advantages of a standard open-rated motor, in addition to the advantage of full protection to the stator, rotor and other internal parts of the motor, all of which are isolated from outside air. This prevents entrance of dust and dirt where present in abnormal quantities, or where its nature and character would have a deteriorating effect upon the windings or rotor.



Century Enclosed Cage Motor

The motor is completely enclosed with ribbed cast-iron coil guards. The fan and fan housing are externally mounted on the front end of the motor—opposite the pulley end. Cooling air is drawn in at the pulley end, circulated around and over the rear coil guard, through the air passages between the field core and the frame, out over the coil guard on the front end, and discharged into the air through the fan and fan housing.

LaFay Thermos Gas Boiler

Built of a steel shell with ⅝ in. copper tubes used as fire tubes, the LaFay Thermos Gas Boiler is being manufactured by the LaFay Thermos and Gas Heating Co., 3946 Cass Ave., Detroit, Mich.

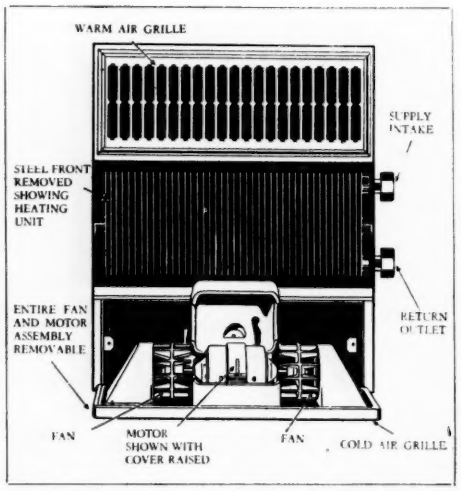
The boiler is enclosed with the Thermos jacket, by means of which the products of combustion are circulated around the boiler after passing through the flues before leading to the stack. They are available in various sizes with capacities from 350 to 2250 sq. ft. of radiation.

Baldor Matched Frame Motors

A special line of frame motors specially designed for fans and blowers, has been brought out by the Baldor Electric Co., 4353 Duncan Ave., St. Louis, Mo.

The line is redesigned with principal mounting dimensions the same regardless of type, whether for single, polyphase, direct current or condenser. Odd frequencies when used where 1800 R.P.M. 60-cycle types are standard, require drilling of two extra holes in the base only. When used where 1200 R.P.M. 60-cycle types are standard, no change is required.

Thrust and lubrication problems are eliminated by the use of ball bearings in a special mounting. Repulsion induction, polyphase and split phase types are of constant speed design. Direct current and condenser types are provided with controls for variable speed.



Front View of Air-Way Aeriet

Fan-Driven Concealed Heater

A concealed light-weight heater with forced circulation has been announced by the Air-Way Heating System Division of the Air-Way Electric Appliance Corp., Toledo, O., under the trade name of Aeriet. It is built in standard sizes to fit between the joists.

The heating element is made of aluminum alloy, a noiseless electric fan being used to force the warm air out into the living area of a room. Where it is desired to use electricity instead of steam or hot water, the heating unit is supplied with electrical current connections. In such installations, there is no heat-glow to the heating unit.

Aeriet units for hot water, steam or electricity can be manually operated or thermostatically controlled. To overcome the under-door sweep of draft from the outside, the manufacturers recommend that the Aeriet be placed on its back with the face plate flush with the floor and the intake just inside the door opening. The motor requires 19 watts input, and, where necessary, many units can be connected across the line to a single thermostat.

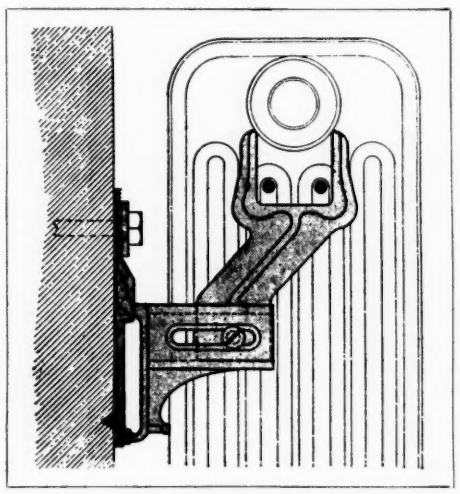
Tarco Radiator Brackets

The Tarco radiator bracket, manufactured and sold by T. A. Ridder Co., Inc., 35 Dover St., Boston, Mass., requires but one bolt to anchor it to the wall, the radiator assuming a vertical position by its own weight. The bracket is adjustable for height by means of a slotted bolt hole and grooved washer.

Lateral adjustment is made by sliding the hook in the slot on the upright wall piece. Sufficient adjustment can be made to cover the length of one radiator section. Adjustment for radiators of various widths is secured by moving the supporting arm forward or back on the hook.

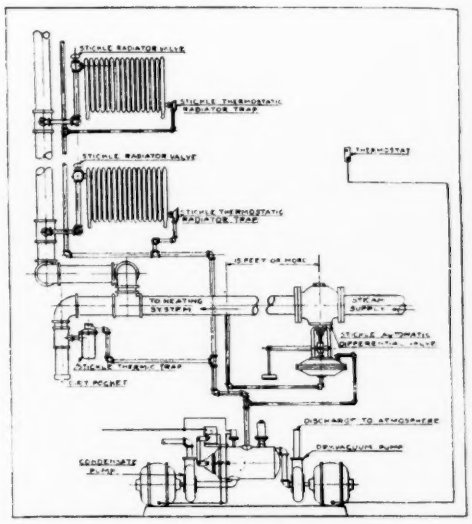
With regular Tarco brackets, the radiators are hung 1¾ in. from the wall; special brackets can be furnished if a 2½ in. space is specified.

These brackets are available in three styles, No. 1 being for all makes of wall radiators; No. 2 being for 3- and 4-tube and 1- and 2-column radiators, while No. 3 is for 5- and 6-tube and 3-column radiators.



Tarco Radiator Bracket

Special attention is called by the manufacturer to the fact that these radiator brackets are made of certified malleable iron.



Layout of Stickle Differential Vacuum System

Stickle Differential Vacuum System

A differential vacuum system based on the idea of changing automatically from low pressures above atmosphere to a low vacuum below atmospheric pressure to vary the heat emission from the radiators, is announced by the Stickle Steam Specialties Co., Indianapolis, Ind. The system functions by increasing and decreasing the vacuum in the return line from the radiators. When the vacuum is increased it actuates the differential valve toward a closed position, decreasing the steam temperature and pressure. When the vacuum is decreased, the valve moves toward an open position, increasing the steam temperature and pressure in the radiators.

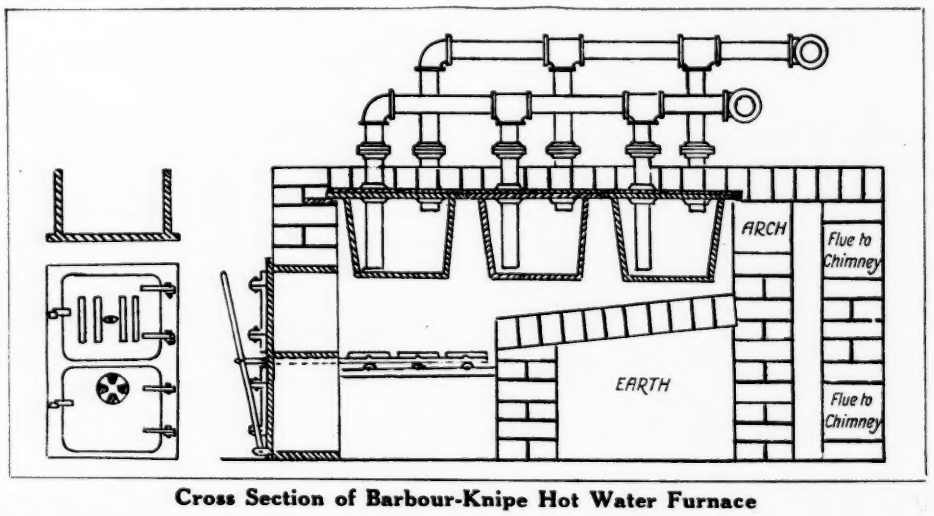
This method of operation produces a positive differential between the steam supply and the return line due to the fact that vacuum in the line is increased before the differential steam valve begins to close.

A continuous circulation of steam is secured by maintaining a constant minimum drop in pressure between the steam supply line and the return line.

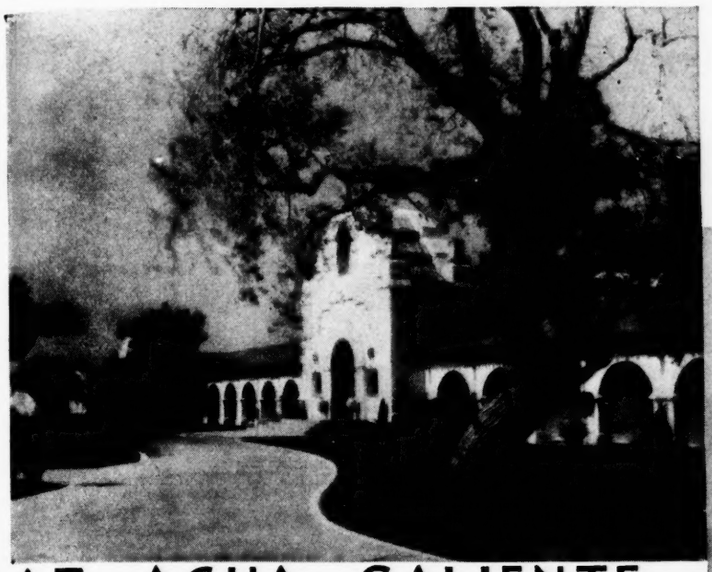
New Heater Has Unusual Features

Patents recently were issued to Rolland M. Barbour, Chicago, and Henry H. Knipe of Lawrenceville, Ill., for a new type furnace for either warm-air, steam or hot water heaters. In this furnace the water is entirely surrounded by fire, rather than having the fire surrounded by water.

The water-carrying elements are so designed that no accumulation of ash or soot can adhere to the element. The patentees claim a fuel economy due to the furnace setting and the clean heating surface.



Cross Section of Barbour-Knipe Hot Water Furnace



Architect:
Wayne D. McAllister, San Diego

Engineers:
Holmes & Sanborn, Los Angeles

Contractors:
Thos. Haverty Co., Los Angeles
Edw. Rohde, San Diego

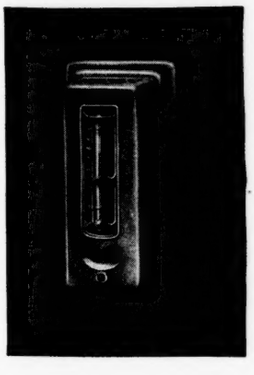
AT AGUA CALIENTE

18 MILES BELOW
SAN DIEGO, CAL.

THEY GAMBLE . . . . . BUT NOT WITH TEMPERATURE CONTROL THEY USE POWERS

Powers Thermostats Are Better

Because—they need no annual adjustments or overhauling—have no fine restrictions to become clogged by dirt—are no larger than others, but thermostatic element is larger—therefore more sensitive and powerful.



NO EXPENSE has been spared in making Agua Caliente one of the most luxurious and comfortable playgrounds to be found anywhere.

Its new $2,000,000 Jockey Club, and beautiful Bath House surrounding the medicinal hot springs, are equipped throughout with the Powers System of Automatic Temperature Control.

The swimming pool, showers, and hot water heaters are also controlled by Powers apparatus.

THE POWERS REGULATOR COMPANY

35 Years of Specialization in Temperature Control

CHICAGO: 2718 Greenview Avenue NEW YORK CITY: 137 East 46th Street

Offices in 35 Other Cities

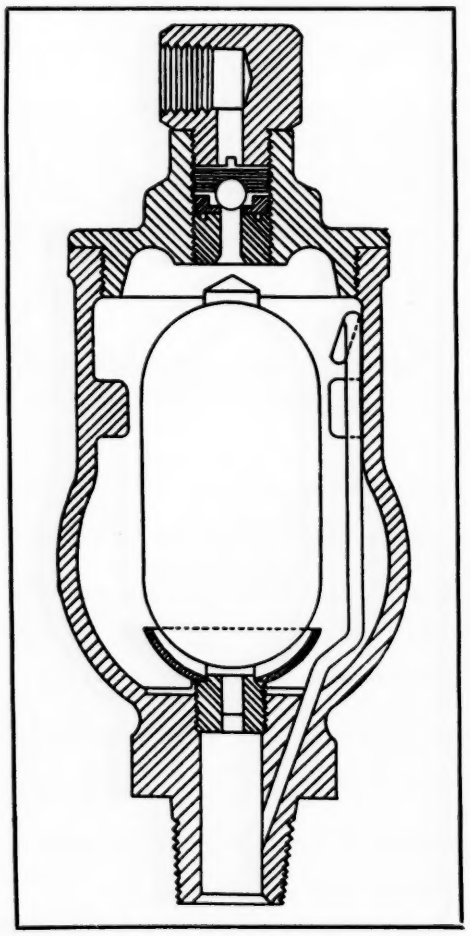
The Canadian Powers Regulator Company, Toronto, Ontario

Apco Automatic Air Relief Valve

Apco automatic air relief valves are being sold by the Automatic Primer Co., 111 W. Washington St., Chicago, Ill. The Apco valve No. 100 is for evacuating air from pump casings, pipe lines and vessels under pressures not exceeding 200 lb. per sq. in. Due to the size of the valve chamber it serves as an air accumulator. The tapping is 1½ in., and its capacity ranges from 15 cu. ft. of air per min. under 10 lb. pressure, to 75 cu. ft. at 100 lb. pressure.

Valves Nos. 110, 120 and 130, are for use in piping systems where air to be vented may collect in large quantities at pressures of 200 lb. or more. All three have 1½ in. tappings, while the capacities at 100 lb. pressure are: No. 110, 75 cu. ft. per min.; No. 120, 75 cu. ft. per min., and No. 130, 80 cu. ft. per min.

Valves Nos. 50, 60 and 70 are for use on piping systems, centrifugal pumps and various tanks or vessels. As ordinarily used they pass air in and out, but will close at once on liquids. By inserting a vacuum ball in the head of these valves, air will be passed out but not in. They are good for pressures up to 125 lb. per sq. in. The tapping sizes and capacities of cu. ft. of air per min. at 10 lb. pressure are: No. 50, ⅜ in., 3 c.f.m.; No. 60, ¾ in., 5 c.f.m.; No. 70, 1 in., 15 c.f.m.



Section of Apco Valve, Nos. 50, 60 and 70

New Trade Publications

Unit Heaters

Winchester Copper Radiators for Unit Heaters and Air Conditioning Equipment. Winchester Repeating Arms Co., Radiator Division, New Haven, Conn. A cross sectional view of a Winchester radiator showing various details of construction is included, together with construction features, and data tables indicating the high rate of heat transfer and low friction loss.

Massachusetts Unit Heaters. Bishop and Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, Ohio. Bulletins 58 and 59 contain valuable engineering data on model V, a floor type heater, and models C and H, suspended types. Detailed diagrams of typical installations are included, together with tables of specifications and dimensions for both floor and ceiling models.

Thermal Unit Engineering Data. Thermal Units Co., Pershing Road and Loomis St., Chicago. This booklet contains complete and valuable engineering data on unit heaters, unit coolers, unit dryers, blast coils, moisture drying, air conditioning and concealed radiation. Size 8½ in. x 11 in. Pp. 77.

What Price B.T.U.'s? Buckeye Blower Co., 400 Dublin Ave., Columbus, O. Instruction is given on the subject of heating airplane hangars and other high roof modern industrial buildings, together with detailed diagrams illustrating the subjects discussed.

York Heat Diffusing Unit Rating Sheets have been received from the York Heating and Ventilating Corp., 16th and Sansom Sts., Philadelphia, Pa. Ratings for models Nos. 422 and 622, 433 and 633, 434 and 634, 444 and 644, and 453 and 653 are given, together with illustrations of each unit.

Water Heating

Rath Internal and External Hot Water Heater. Folder from the Rathgeb Grate Co., Inc., 2365 Third Ave., New York, in which detailed illustrations of the two types of heaters are presented, together with a short description of each.

Cochrane Self-Contained Deaerator and Hot Water Generator. The Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia, Pa. This bulletin, 686, describes the Cochrane combined deaerator and hot water generator for supplying hot, deaerated water to heating and hot water service systems. This apparatus heats the water to a temperature determined by thermostatic control and also drives off oxygen and other dissolved gases so that the water will not corrode iron, steel or brass piping, heating coils, etc., and will not, therefore, cause troubles from leakage or choking up of piping or from "red water." The water is not heated by direct contact with the steam, as in ordinary power plant deaerating heaters, but by means of heating coils, so that the steam used for heating is kept apart from the water being heated. Diagrams showing hot water piping systems adapted for various types of buildings are included in the bulletin. Size 8½ in. x 11 in. Pp. 20.

Electric Heating

Electricity Now Heats the Home is announced on the cover of a booklet received from the Hall Electric Heating Co., Inc., 1429 Walnut St., Philadelphia, Pa., in which the operation of the Hallmark heating system is described. Illustrations of residences in which Hallmark heaters are installed, together with the heating requirements and letters of commendation on the results obtained in each house, are included.

The folder contains also two diagrams showing the principle of operation of the Hallmark heating system in the night and morning and a typical plan of an installation. Size 5¾ in. x 8¾ in. Pp. 16.

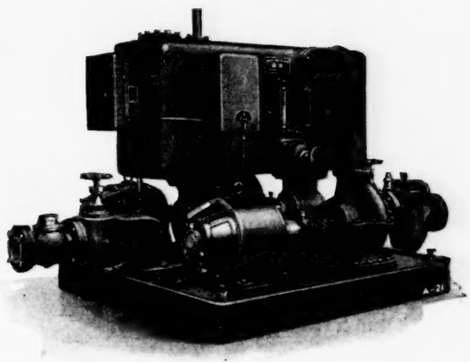
Pumps

Chicago Quality Centrifugal Pumps. A large catalog published by the Chicago Pump Co., 2336 Wolfram St., Chicago. This company, which this year is celebrating its 20th anniversary, has compiled a great deal of valuable information about its products. Various models of pumps and their applications are described, together with detailed diagrams, engineering data, curve charts, blueprints, etc. Size 8½ in. x 11 in. Pp. 195.

Economy Pumps. Economy Pumping Machinery Co., Chicago, Ill. Bulletin 414 describes a line of small capacity multistage pumps. The manufacturer has felt that although a great deal of development has been done on large capacity pumps, there was a demand for dependable high efficiency pumps of capacities below 400 G.P.M. The catalog describes the attempt of the company to meet this demand and gives complete selection tables, dimensions and description.

SERVICE SUCH AS THIS

2" vacuum with condensate at 209° F. without flashing or adding of cooling water, and discharging all returns to the boiler without waste

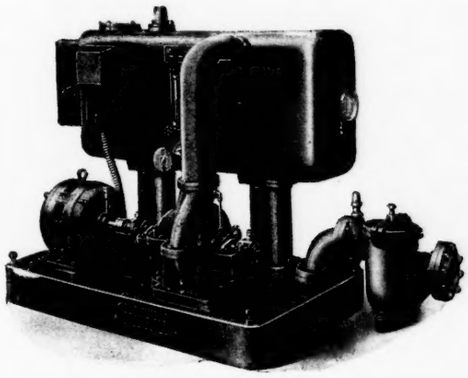


makes

AMES

The Vacuum Pump of Performance

Distinctively Different



AMES PUMP COMPANY, Inc.
30 Church Street New York City

Affiliated with
AMERICAN LOCOMOTIVE COMPANY

Oil Burning

Oil Heat for the Architect and Engineer. Automatic Burner Corp., 312 No. May St., Chicago. A simple and concise explanation of modern oil heating, containing engineering data for the engineer and architect. Oil as a domestic fuel, the cost of oil heat, classifying oil-heating systems, selection of burner conversion units, test reports, and installation and architect's specifications are some of the chapters included in this booklet, written by Stanley Perry, assistant chief engineer of the Automatic Burner Corporation. Size 8½ in. x 11 in. Pp. 32.

Petro as a Business. Petroleum Heat and Power Co., Stamford, Conn. In this booklet is told the story of the development of this company and its products by means of attractive illustrations. Size 12 in. x 15 in. Pp. 24.

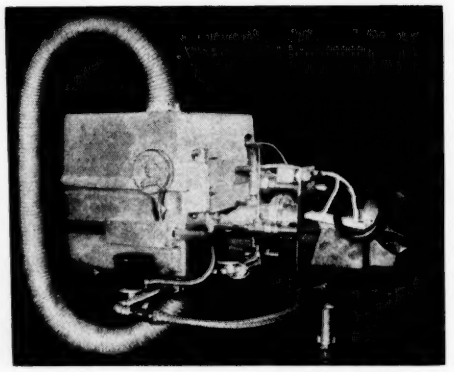
The Story of Nu-Heat. Nu-Heat Corporation of America, St. Louis, Mo. The progress of heating through the centuries to automatic heat is told in an interesting manner. A detailed description of the Nu-Heat burner is included, together with the new extra profits sales plan of the company, which offers substantial advertising and sales help to the dealers.

Guaranteed Oil Heat. Petroleum Heat and Power Co., Stamford, Conn. The advantages of oil heat are presented in this booklet. A general description of the Petro oil burner, with illustrations of various sizes of burners for all types of buildings, and a chapter devoted to the progress made by the company in the last twenty-five years are included. Size 6 in. x 9¼ in. Pp. 24.

Master Furnace Man. A booklet published by Electrol, Inc., St. Louis, Mo., containing useful information regarding automatic oil heating and its application to the home. Numerous illustrations of typical installations are presented, together with answers to some of the important questions that have been asked about Electrol. Size 7¾ in. x 11 in. Pp. 24.

Make Oil Heat Fully Automatic; Feeding Fuel to the North Winds, and How Much of Your Gas Dollar Buys Heat. Three folders issued by the Draft-A-Justor Corp., 228 N. La Salle St., Chicago. The use of the draft-a-justor for automatically maintaining without variation the precise draft necessary for the most efficient operation of gas conversions, coal-fired boilers and furnaces, and oil-burning installations are featured.

Your Oil Burner Can Be a Lifetime Investment. Summerheat Corporation of America, Dowagiac, Mich. This



T-9 De Luxe Summerheat

booklet presents the "Whispering" series of the Summerheat electric oil burner. Specifications and glossy prints are included, illustrating the following models: Type "T"—9 DeLuxe, Type "S"—9 Standard, and Type "Ideal"—9. A reproduction of the five-year rehabilitation bond, which is given to every purchaser of a Summerheat burner, appears on the back cover.

Domestic and Industrial Fuel Oils (Commercial Standard CS12-29). Bureau of Standards, U. S. Department of Commerce. Washington, D. C. This booklet contains the detailed requirements for domestic and industrial fuel oils and outlines the various methods of testing. These standards, which became effective on July 15, 1929, have been accepted by a large majority of associations, refiners, firms and publications interested in the subject. A list of the standing committee, which was appointed to represent the various elements in the industry, and who will receive all comments and suggestions for the improvement of the specifications, is included. Size 6 in. x 9 in. Pp. 14. Price 5c.

Valves

Smolensky Noiseless Flanged Check Valves. Bulletin No. 3 from the Smolensky Valve Co., Cleveland, O. The valves are described and illustrated, together with tables of dimensions and prices for each model. Illustrations of typical installations are included, together with a partial list of recent installations in New York City.

Boiler Water Treatment

The Economy of Soft Water. Bulletin 120. Elgin Softener Corp., Elgin, Ill. Discusses the advantages of soft water in various industries, problems of scale, rust, corrosion, incrustations and influence of hard water upon fuel bills, textiles, linens, etc. Features of the Elgin Zeolite System are discussed as well as how to perform regeneration of the Zeolite bed. A section devoted to boiler water goes into the Elgin Zeolite-Deconcentrator combination, the continuous blow-down system with heat exchanger and the Elgin Deconcentrator. The bulletin is well illustrated with installation views, together with a schematic diagram of the Zeolite Softener installation in combination with the Elgin Deconcentrator for boiler water treatment and a diagrammatic sketch of the Zeolite Softener and brine tank and control system. Pp. 16.

Boiler Specialties

Reliance Safety Water Columns, catalog R, published by the Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland, O. The various types of columns, together with their sizes and list prices, are described and illustrated. Instructions for installations, and part of the A. S. M. E. Code regarding the installation of water columns for power boilers are included. Size 8½ in. x 11 in. Pp. 16.

Insulations

Adsco Casing is Over 91% Efficient is the caption appearing on a folder issued by the American District Steam Co., No. Tonawanda, N. Y. A detailed view of the Adsco Red Diamond Brand casing is shown and the casing described.

Power Plant Equipment

Equipment for Steam Power Plants. Schutte & Koerting Co., Philadelphia, Pa. Booklet No. 1 describes and illustrates the new line of SK equipment for the boiler room and turbine room, including valves, evaporators, heaters, injectors, fuel oil heaters and burners, desuper-heaters, pumps, condensers, cooling systems, etc. Size 8 in. x 11 in. Pp. 28.

Separators

Cochrane Separators. The Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia, Pa. Separators for removing water, oil and solids from currents of live or exhaust steam and from air or other gases, are described in this bulletin. Numerous tables and diagrams are included giving sizes and dimensions of separators for various services, such as live steam, exhaust steam and air and gas lines, and including receiver separators and steam purifiers for removing water and solids from steam delivered by high rating boilers before it enters the superheater and steam mains. This publication presents a great deal of worthwhile information on the installation of steam and oil separators, the laying out and flow resistances of pipe lines, the selection of cylinder lubricants, testing of oil in condensate and other related subjects. Size 8½ in. x 11 in. Pp. 89.

You've got to release the B.T.U's.

THE best unit heater is the one that gets rid of the most heat—the one that best takes B. T. U's. out of the steam and puts them into the air blast.

In the WINCHESTER Copper Radiator there are no extended surfaces, no fins, no flanges. Every ounce of metal is prime surface with steam outside the tube and air inside—the ideal design for efficient radiation.

This 100% prime surface construction releases the heat units fast. With it, the air blast is heated to a high temperature and the heat is removed from the steam more effectively.

Any unit heater can be supplied with a WINCHESTER Copper Radiator core. It is necessary only to specify "with WINCHESTER Copper Radiating Service" to get this most efficient radiator in your unit heating equipment.

Even with plenty of steam and an ideal piping layout, if the radiating surface is sluggish in action you can't get the most efficient results from unit heaters

WINCHESTER
TRADE MARK

COPPER RADIATORS

RADIATOR SALES DIVISION
WINCHESTER REPEATING ARMS CO., NEW HAVEN, CONN., U. S. A.

Trade and Miscellaneous Notes

Coming Events

March 14-15, 1930. Annual meeting of Western Supply Association at Del Monte, Calif.

March 25-26, 1930. The 104th regular meeting of the Central Supply Association in Chicago, Ill. Headquarters at the Palmer House.

March 31-April 5, 1930. New York's twelfth annual Home Show at the Grand Central Palace, New York.

April 7-12, 1930. Seventh annual convention of the American Oil Burner Association in Chicago, Ill. Headquarters at the Hotel Stevens.

May 5-7, 1930. Convention of the National Pipe and Supplies Association, at Pinehurst, N. C. Headquarters at the Carolina Hotel.

June 3-5, 1930. Twenty-first annual convention of the National District Heating Association in St. Louis, Mo. Headquarters at Coronada Hotel.

June 16-19, 1930. Forty-first annual convention of the Heating and Piping Contractors National Association in New York. Headquarters will be announced.

June 23-27, 1930. Exposition to be held in connection with the annual convention of the National Association of Master Plumbers, in Boston, Mass. Headquarters at the Mechanics Build-

June 24-27, 1930. Summer meeting of American Society of Heating and Ventilating Engineers, Minneapolis, Minn. Headquarters at Curtis Hotel.

Domestic Stoker Convention

Domestic Stoker Co., 7 Dey St., New York, manufacturers of the Electric Furnace-Man, held its third annual convention at the Hotel McAlpin, New York, February 17, with an attendance of 233, of which 201 were distributors, dealers and members of the company.

Advertising and merchandising programs for the year were outlined and the possibilities in the automatic home heating field analyzed. An interesting series of pictures were shown of some of the 10,000 and more installations where the Electric Furnace-Man is now being used in warm-air plants, steam, vapor and hot water boilers, etc. Also installations in magazine boilers and in boilers designed especially for gas.

Considerable attention was given to the coal dealers and the necessity of cooperation between them and the company was stressed. It was pointed out that the coal dealer must modernize his product to make it acceptable to the public and that he is now in a position to meet the demand for modern automatic heat with anthracite.

After the evening banquet, there were a number of talks referring particularly to the merchandising of Pennsylvania anthracite and stoker equipment.

Petroleum Heat Buys Power Plant Engineering

In accordance with its expansion policy, Petroleum Heat & Power Company has acquired the Power Plant Engineering Company of Seattle, Wash., Portland, Ore., and Tacoma, Wash. This brings under the Petro banner the largest oil-burner distributor on the Western Coast. In addition to the Power Plant Engineering Company, the Fess System Company, of San Francisco, is also a subsidiary of Petroleum Heat.

The Power Plant Engineering Company was incorporated in 1920 by R. S. Whaley and A. E. MacInnis, who have remained equal owners in the business until its recent sale. The Power Plant Engineering Company was for many years the largest distributors of the Ray oil burner and, afterwards, of the Oil-O-Matic line.

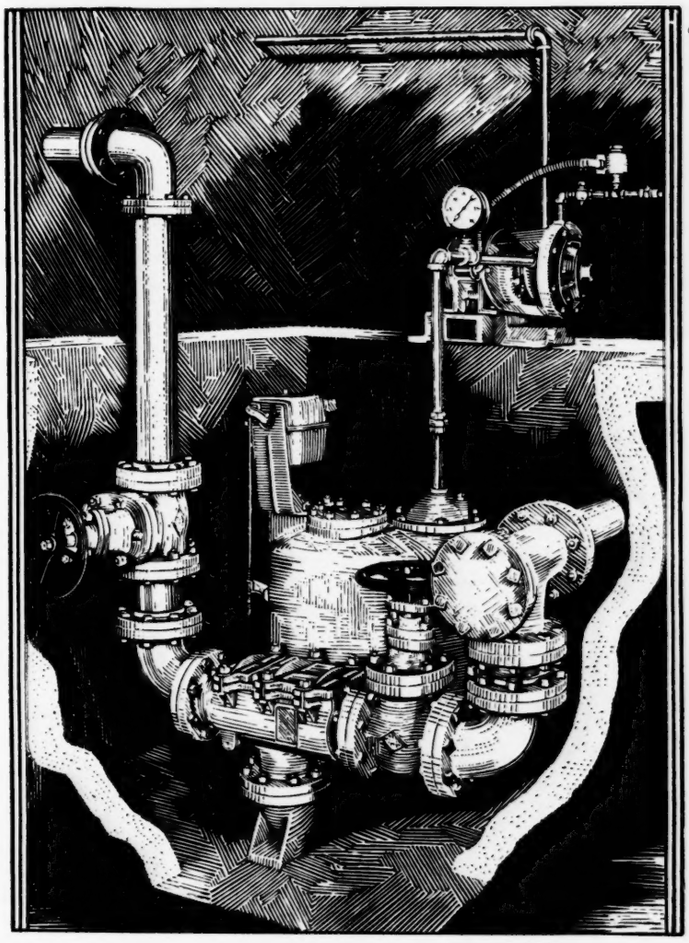
In October, 1927, Mr. MacInnis left the presidency of the Power Plant Engineering Company to become president of Preferred Oil Burners, Inc., manufacturers of the Hart oil burner. Power Plant Engineering Company then became a Hart distributor. Mr. Whaley was made president of the Power Plant Engineering Company and, under his leadership, Hart sales far surpassed any previous record made with any other equipment. Mr. Whaley will continue as president of the Power Plant Engineering Company; in addition, he has been made vice-president of the Petroleum Heat and Power Company.

To the activities of the Power Plant Engineering Company will be added representation of all products manufactured by Petroleum Heat and Power Company, including a complete line of Petro, Nokol, and Fess oil burners, the latter being manufactured by the Fess System Company of San Francisco.

A. E. MacInnis will be president of the Fess System Company, with headquarters in San Francisco. In addition, he has been made vice-president of Petroleum Heat and Power Company.

The Fess System Company established in 1903, is one of the pioneers in

Convention Dinner of Domestic Stoker Company, at Hotel McAlpin, New York



Jennings Type B Sewage Ejectors have capacities of 30 and 50 g. p. m. Heads up to 50 ft. Type A, Jennings Units are supplied with capacities up to 1500 g. p. m.

PNEUMATIC EJECTORS are by far the most satisfactory equipment for lifting unscreened sewage from deep basements and discharging this sewage into the street sewer. But, until the Type B Jennings unit was developed, the pneumatic ejector was not available in small capacities.

Now...

a pneumatic ejector for handling 30 and 50 g. p. m.

A Type B Jennings Ejector compares favorably in first cost with other types of equipment. Unlike a sewage pump, it has no submerged impeller or other vital working parts to become caked with solid matter and lose efficiency. Air is compressed and supplied to the receiving pot at the required pressure, and then only when needed to move the sewage. Large inlets and outlets permit the Jennings Ejector to handle without clogging, anything that will pass through a four inch elbow . . . If you are not familiar with Jennings Sewage Ejectors, write for Bulletins 103 and 108 . . . The Nash Engineering Co., 81 Wilson Road, South Norwalk, Conn.

Jennings Pumps

the oil-burner industry. It was from M. A. Fessler, from whom the Fess gets its name, that W. C. MacTarnahan went to the east coast in 1915, and Mr. Fessler in 1917, where they incorporated the original Fess ideas in the Petro burner.

The present plan of the Petroleum Heat and Power Company for the expansion of its California and Southwestern business through its subsidiary, the Fess System Company, is illustrated in the selection of Mr. MacInnis as president. Mr. MacInnis has left to make his home in San Francisco.

Miscellaneous Notes

January building operations, as reported by the F. W. Dodge Corporation, showed that for the first time in nine years, the total for this month of building and engineering contracts exceeded the total for the preceding December by 2%. The month's contract-volume in dollars was 21% behind that for January, 1929. The total figures for the 37 states east of the Rocky Mountains were $323,975,200. Analysis of this record shows that 35% of all construction was for public works and utilities, 21% for residential buildings, 17% for commercial buildings, 12% for industrial buildings and 6% for educational buildings.

Construction contracts in the New England States amounted to $17,860,300. Compared with the December total this shows an increase of 12%, but compared with the January, 1929 total, there was a decrease of 39%. In Metropolitan New York and Northern New Jersey, contracts amounted to $69,222,500. When compared, the past month's total showed a drop of 35% from December and a decrease of 24% from January, 1929. In Up-State New York contracts amounted to $9,011,800, showing an increase of 4% over December but a decrease of 16% from the total for January, 1929.

In the Middle Atlantic States, the total figures were $67,248,000, representing a tremendous increase over December, for which month the total figures were $21,389,900, and the January, 1929, total was $49,083,400. Contracts in the Pittsburgh District amounted to $37,677,800, representing an increase of 38% over the total for December, but a decrease of 34% from the total for January of last year.

In Southern Michigan, Chicago District, and the Central Northwest, contracts amounted to $9,900,200; $31,647,800, and $2,497,000, respectively. In Southern Michigan there was a decline of 64% from the December total and a decrease of 40% from January, 1929. Chicago territory had a decrease of 43% from December and 53% from January, 1929. In the Central Northwest there was a decrease of 64% from December and 62% from the total for January, 1929.

Figures reported for the St. Louis and Kansas City Districts amounted to $24,208,700. This represents an increase of 17% over the December total, for the St. Louis territory, but a decrease of 46% from January, 1929. In the Kansas City territory there was an increase of 74% over the total for December, but 15% less than the total for January of last year. In the New Orleans territory there were contracts amounting to $15,063,600, which was four times the amount contracted for in December and over twice the amount let in January, 1929.

In Texas, figures were $18,116,300, showing an increase of 50% over the preceding month and 14% over the record for January, 1929. The Southeastern territory reports contracts amounting to $21,523,200, an increase of 47% over December and 20% under the total for January, 1929.

Midwest Bituminous Coal Conference will be held at Purdue University, Lafayette, Ind., April 9-11. The conference is sponsored by the Engineering Extension Department of Purdue, the Coal Trade Association of Indiana and the Illinois Coal Bureau, representing Southern Illinois producers, in collaboration with the Fuels Division of the American Society of Mechanical Engineers. This three-day educational session is to mark the beginning of a series of similar annual meetings, alternating between Purdue University and the University of Illinois. The purpose of these conferences will be to determine newer means and better methods by which Illinois and Indiana coals shall have wider and more satisfactory application, and midwest consumers will be guaranteed a more economical fuel. Among the speakers at the conference will be: T. A. Marsh, Combustion Engineering Corp., in Chicago; Frank A. Chambers, chief smoke inspector of the City of Chicago; John Hunter, consulting engineer for the City of New York; A. C. Willard, University of Illinois; Dean A. A. Potter, Purdue University; Alex D. Bailey, chairman engineering division, N.E.L.A.; Prof. C. H. B. Hotchkiss, Purdue University. One feature of the conference will be the exhibition of stoker and boiler units in actual operation.

The Institute of Boiler and Radiator Manufacturers, at a meeting held in January at the Hotel Astor, re-elected H. T. Richardson, of Richardson & Boynton Company, as chairman. C. B. Penny, Republic Radiator Co., Baltimore, Md., was elected vice-chairman. The following will serve on the executive committee: J. H. Waters, president, National Radiator Corp.; M. J. Beirn, vice-president, American Radiator Co.; E. E. McNair, president, United States Radiator Corp.; Stanley M. DeLong, president, Pierce, Butler & Pierce Mfg. Corp.; Isadore Weil, president, Weil-McLain Co.; R. C. Cook, vice-president, Thatcher Co., and Dr. F. T. Nason, president, Columbia Radiator Co. F. W. Herendeen, of Geneva, N. Y., was re-elected secretary and treasurer, and will serve on the board with the chairman and the vice-chairman as ex officio. Col. William J. Donovan withdrew as counsel and W. J. Matthews, attorney of New York City and Chicago, was selected as his successor.

John R. Collette, sales manager of Pacific Steel Boiler Corp., Waukegan, Ill., has removed his office from Waukegan to headquarters of the company, the United States Radiator Corporation at Detroit, Mich.

Dr. F. E. Geisecke, director of the Texas A. & M. Engineering Experiment Station, who is assisting the Texas Prison Committee in formulating plans for the reorganization of the Texas Prison system, has returned from a four-months' trip through Europe, where he made a study of research laboratories, etc.

Ryuzo Goto, inspector of mechanics in the Mukden office of the South Manchurian Railway, was a recent visitor to the editorial offices of HEATING AND VENTILATING. He had some interesting things to say of the growing demand for American heating and ventilating products in that section of the world.

John Wilde, of the Wilde Burner Corp., Bayside, L. I., N. Y., dealers for Toridheet oil burners, has been elected president of the Greater New York Oil Heating Association, to succeed M. E. Simpson, vice-president of Electrol, Inc., who has resigned. At this meeting, held in January, it was agreed to rewrite the by-laws of the association and to appoint a committee to outline the organization's plan of action for the coming year.

F. W. Broatch, a past president of the Metropolitan Trade Golf Association, has resigned as New York manager of the United States Sanitary Mfg. Company, of Pittsburgh, Pa. On account of ill health of Mrs. Broatch, they have left for a trip around the world. Mr. Broatch announced at the annual dinner of the golf association that he is not retiring from business permanently.

Manufacturers' Notes

Langenberg Mfg. Co., St. Louis, Mo., reports that at the annual meeting of the board of directors, held January 29, George F. Langenberg, formerly president of the company, retired from active management and becomes chairman of the board. The following officers were

A steam trap *tested-in-the-making* now offered by GRINNELL

GRINNELL COMPANY has discovered the one trap which meets its own exacting standards. It is a discovery of great importance because never before could a trap be tested in its making.

The heart of this ThermOflex trap is the Hydron bellows. By the process of its manufacture, each and every Hydron bellows must stand up under a pressure several times as powerful as it will ever be given on any piping job.

"What! Tested in the Making?"

The famous ThermOflex Hydron bellows is formed from the original tube by several hundred pounds internal hydraulic pressure. That is why this sturdy yet sensitive bellows will open and close millions of times without any signs of giving out.

The end fitting is joined to the tube *before* the hydraulic pressure shapes it into a bellows. Therefore, the tremendous internal pressure also tests the end fitting far beyond any pressure the bellows will ever be called upon to stand. Any weakness in either the tube or the end fitting would then and there destroy the bellows. Thus the ThermOflex Hydron bellows is *self-inspected* and *proof-tested in the making*.

Grinnell Company is the exclusive distributor for these traps. Years of unfailing service in all types of buildings and under severe and varied conditions have proved their unfailing value, their uniformly high quality, their long efficient service.

Let our sales engineers work with you to insure permanent satisfaction.

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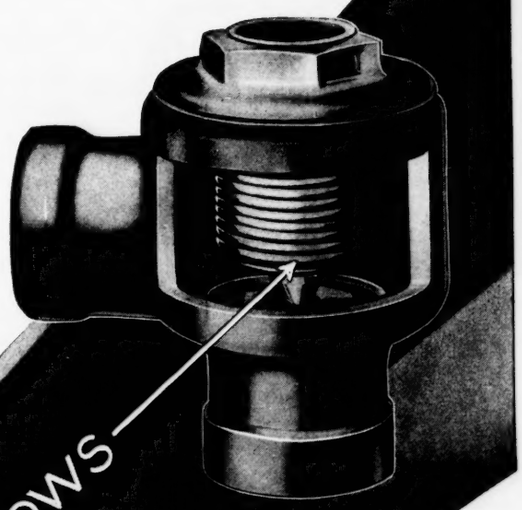
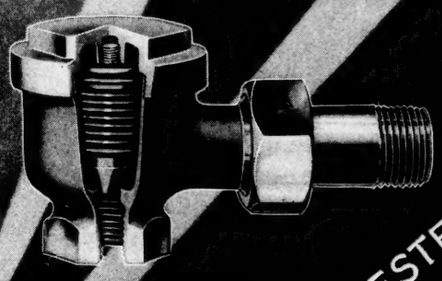


No. 4 ThermOflex Drip Trap

For dripping mains, risers, coils and unit heaters, we offer this type of trap. Cast-iron body, brass cap and inserted brass seat, angle pattern only, without unions.



No. 12 ThermOflex Radiator Trap

Body is extra heavy throughout, using a brass forging for the cap and spudnut, highest-grade cast brass for the body and spud.

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I want to read more facts about ThermOflex Traps. Send along your bulletin giving capacities and dimensions.

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elected: President, E. B. Langenberg; vice-president, J. J. Walsh; secretary and treasurer, G. L. Kleeber; sales manager and chief engineer, A. L. Walters.

Bryant Heater & Mfg. Co., Cleveland, O., announces the appointment of Geoffrey D. Yeaton, formerly of the Boston office of the company, as assistant to J. M. Traugott, Atlantic district sales manager, with headquarters at Philadelphia. This district comprises the territories of Baltimore, Pittsburgh, and Metropolitan New York, as well as Philadelphia.

Quaker Mfg. Co., 215 North Michigan Ave., Chicago, Ill., announces the appointment as distributor for Canada of the Fess Oil Burners of Canada, Ltd. The Preferred Utilities Co., Inc., of New York and Boston has been appointed distributor for Southeastern New York, Northern New Jersey and all of New England.

Lancaster Iron Works, Inc., Lancaster, Pa., has purchased the entire business of the Monitor Bi-Loop Radiator Company of Lancaster, and will manufacture the line of Monitor U-Tube boilers. These boilers have been on the market since 1888. The organization is equipped to handle this work in its two plate shops, pattern shop, foundry and machine shops.

The Mercoid Corp., Chicago, Ill., announces that through its license, under patent reissue No. 15,531, the trade is assured full protection to use its Furnace Fan Control M-53 for any and all furnace fan applications. The corporation also announces the acquisition of a large modern plant, consisting of 90,000 sq. ft. of floor space to meet growing needs. This plant is located at 4201 Belmont Avenue and it is expected to be occupied by April.

B-Line Boiler Co., Cleveland, O., has appointed George B. Shawn chief engineer of the company. Mr. Shawn formerly was associate director of the American Gas Association Testing Laboratory at Cleveland. Prior to entering the A.G.A. work, Mr. Shawn spent several years with the United States Bureau of Standards in the field of burner design research in comparative studies of appliance operations on gases of various kinds and in the study of combustion with all kinds of domestic appliances. He is joint author of Technologic Papers Nos. 193, 22, 303.

Herman Nelson Corp., Moline, Ill., in its annual report to stockholders, announces the most prosperous year in the history of the company, with common stock earning $4.02 a share during 1929. The sales volume showed an increase over 1928 of 33 1/3%. Net earnings, after depreciation and taxes, were $464,664 in comparison with $366,930 for the previous year. Instead of purchasing the majority of the parts used in the manufacture of its heating and ventilating equipment, the company will make its own sheet metal parts. The former Velie truck plant has been bought by the company and is being renovated and new machinery installed; 75 men will be employed when operation gets under way.

Oil-Elec-Tric Engineering Corp., Minneapolis, Minn., was formed recently to take over the manufacture and sale of Oil-Elec-Tric burners. Formerly assembled in the plant of the Campbell Machine Company, this burner has shown a growth in sales, making necessary increased manufacturing facilities. Charles G. Sigwald, designer of the burner, is chief engineer of the new corporation. A. H. Coffin has resigned his position as sales manager of the Progressive Machinery Company, to become associated with the new company in charge of sales and advertising. New 1930 models are on display in the company's showrooms in the new plant at 2937 Fourth Ave. South, Minneapolis.

Connersville Blower Co., Inc., Connersville, Ind., at a recent meeting of the board of directors, made the following changes in personnel: John T. Wilkin, president and chief engineer, was also appointed general manager; Bernard C. O'Brien, formerly in charge of sales in Pittsburgh, was elected secretary; W. E. Newkirk, purchasing agent, becomes treasurer, and E. C. Hassler, assistant superintendent, was appointed acting superintendent.

Crane Co., of Chicago, Ill., has made arrangements with the First Bank Stock Corporation to handle the financing of the Crane budget plan for the sale of heating and plumbing equipment through contractors on a monthly payment basis. The First Bank Stock Corporation will handle the new business through a subsidiary, the First Bancredit Corporation, which will establish branches of the financing company.

May Oil Burner Corp., Baltimore, Md., reports that at a recent special meeting of the board of directors, an extra dividend of 50 cents per share was declared on the common stock. The earnings for 1929 were double those of 1928, it was stated. The company also announces the establishment of a factory and subsidiary organization in Toronto, Canada, to take care of the expanding demand for its product.

A. M. Byers Co., Pittsburgh, Pa., announces the following additions to its sales personnel: D. S. Sampson assigned to the New York office, under division manager G. W. Hamill, to cover New Jersey territory; R. C. Hamlett assigned to New Orleans, under the direction of division manager, A. D. Sheere of Atlanta; Irvin P. Young, with headquarters at Chicago, under the direction of division manager, M. G. Henderson; T. D. Graham, assigned to St. Louis territory, also under Mr. Henderson.

Bryan Steam Corp., Peru, Ind., has established a Boston office and warehouse from which boilers will be distributed to the New England territory. The office will be under the supervision of A. B. Coop and the exact location will be announced later. In the meantime the boilers will be on display at the Architects' Exhibit Corporation. Another announcement is that the sales force has been increased through the addition of William F. Hitzeman in the Fort Wayne district, E. A. Orpurt, Rockford (Ill.) district, and D. C. Tyner in the Milwaukee district.

P. H. & F. M. Roots Co., Connersville, Ind., original patentees and for 70 years manufacturers of rotary positive blowers, pumps and meters, has merged with other interests and is now under the control of the Stacey Engineering Company, of Columbus, O. The new organization includes the Roots company, Connersville Blower Co., Wilbraham-Green Blower Co., Pottstown, Pa., and the Stacey Brothers Gas Construction Co., Cincinnati, O. The new officers are: President, Col. Carmi A. Thompson, Cleveland; vice-president and general manager, Corwin Abbott; vice-president, Fletcher S. Heath, Columbus, O.; secretary and treasurer, Erle G. Meeks. Charles T. Gordon will continue as general superintendent. E. D. Johnston, for the past 45 years with the Roots company, has resigned as president and retired from active business. All companies involved in the merger will maintain their separate identities and organizations, and will continue to operate until the final plans of the merger are consummated.

Peerless Unit Ventilation Co., Inc., Bridgeport, Conn., has appointed A. M. Farrier as general sales manager of the company. Mr. Farrier has been associated with Thomas A. Edison, Inc., as a vice-president, and also as a vice-president for seven years with the Easton Car & Construction Company.

D. & T. Mfg. Co., St. Louis, Mo., in establishing a warehouse to expedite deliveries to jobbers and distributors in that location, has appointed Derbyshire, Mack & Morgan, Inc., as sales representative in the Philadelphia territory, with offices at Delaware Ave. and South St., Philadelphia.

Changes of Address

Iron Fireman Mfg. Co., Portland, Ore., has moved its office in Charlotte, N. C., from 307 Worthington Avenue to 403 Builders Building.

Time-O-Stat Controls Co., Chicago, has moved its executive and sales offices from the Peoples Gas Building to the Daily News Building, 400 W. Madison St.

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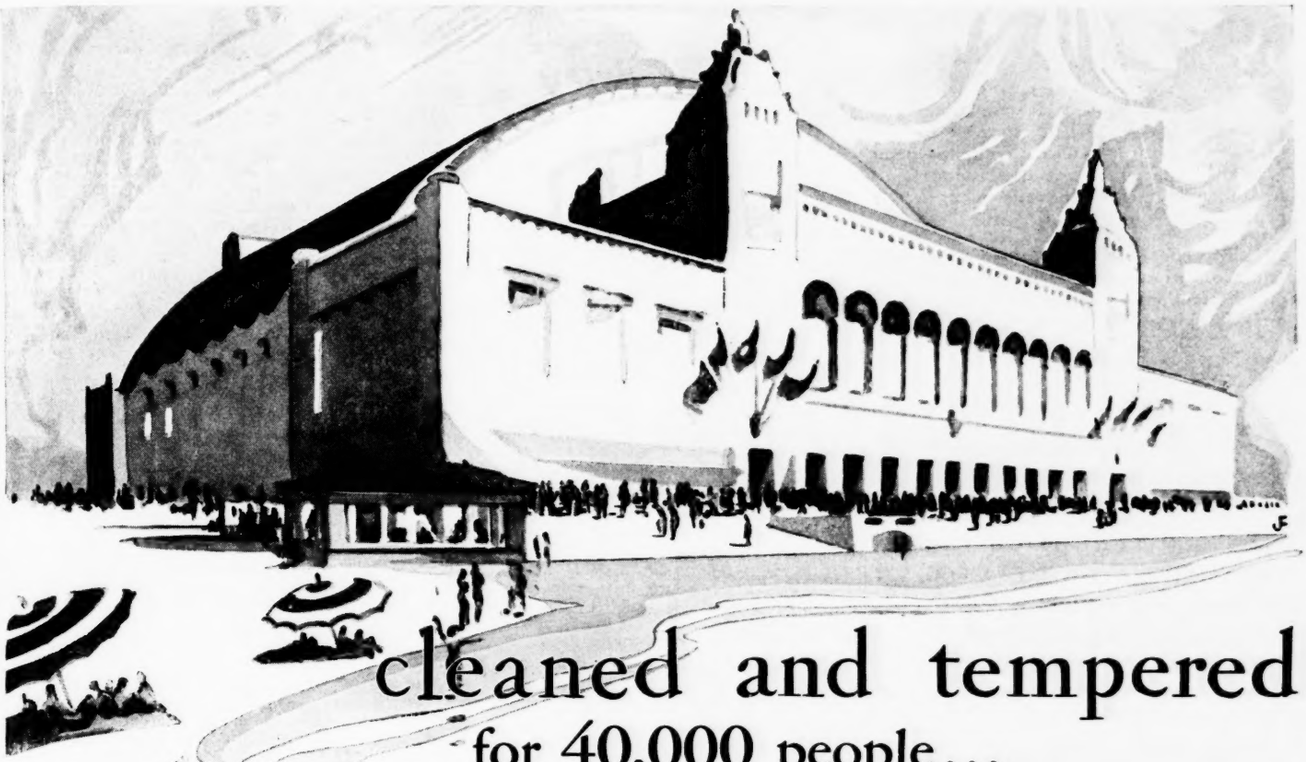

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Manufacturers representative, 20 years in industry, will represent in New York and territory radius of one hundred miles, responsible manufacturers of heating, ventilating, drying, air conditioning equipment and power engines, pumps and equipment. Box 96, care of Heating and Ventilating.

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Only those with technical education and thoroughly experienced in one or more of the lines will be considered. Give complete history of selling experience with reference to territory covered, name of company now associated with, etc. Applications confidential.

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Boiler Salesman for steel heating boilers in Indiana, Iowa and Wisconsin. Exclusive territory given to successful men having experience in heating trade. Address Box 99, care of Heating and Ventilating.

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15,000 Sq. Ft.
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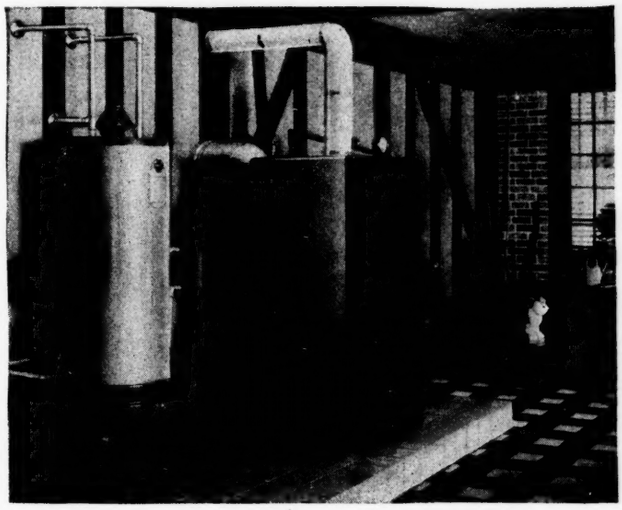

"IN spite of a dull real estate market," writes Louis Segal, the builder of these houses, "they have sold well." In each one is an "All-American" heating system including a Redflash Boiler, Corto Radiators and Hotcoil Gas Water Heaters. "In supporting your products," he continues, "Mr. Picker, our heating contractor has met with our ideas too that the appeal of your products makes homes more salable."

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Write for our latest literature and details on our partial payment plan — that gives you your money at once and your customer two years to pay.

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Division of

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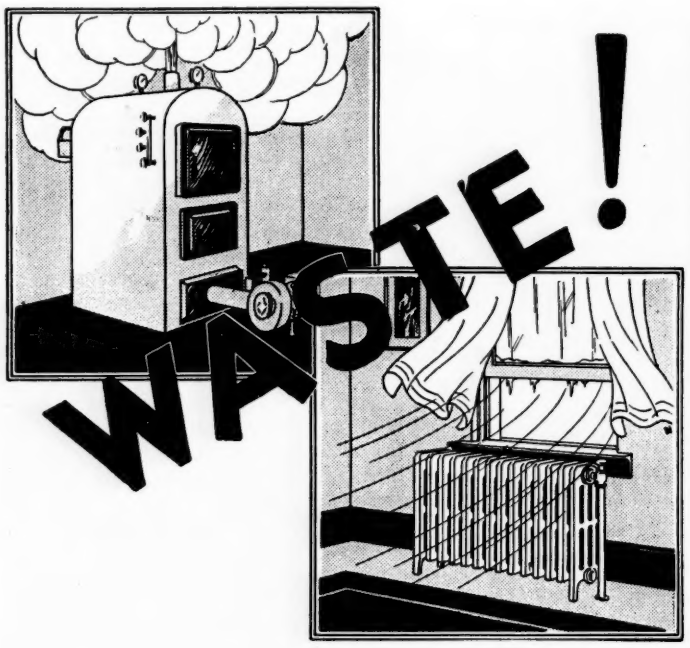

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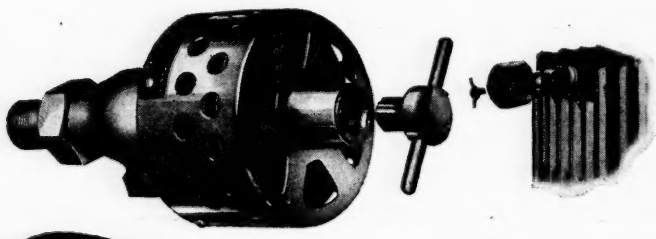
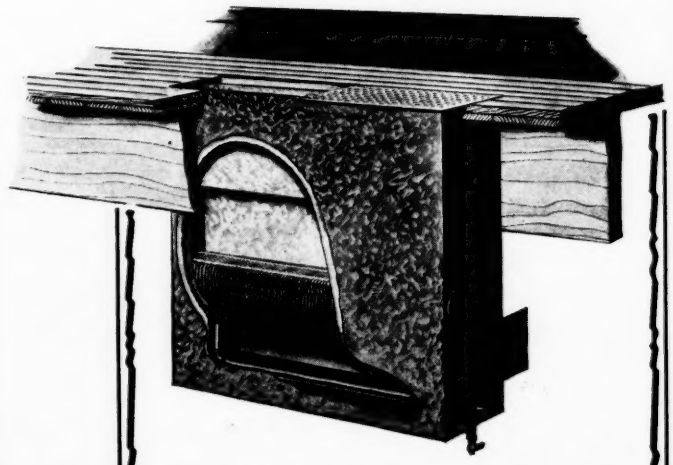


The Thermotrol



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Pressure *and* Temperature
2 in 1
"Master Control" Valve
(PATENTED)
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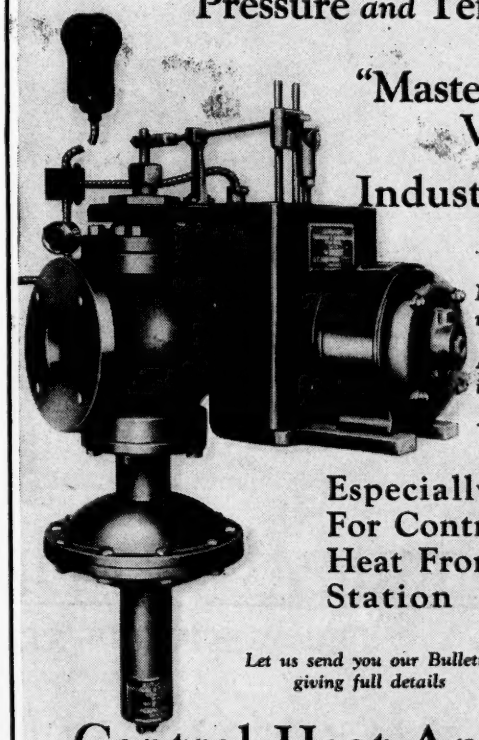

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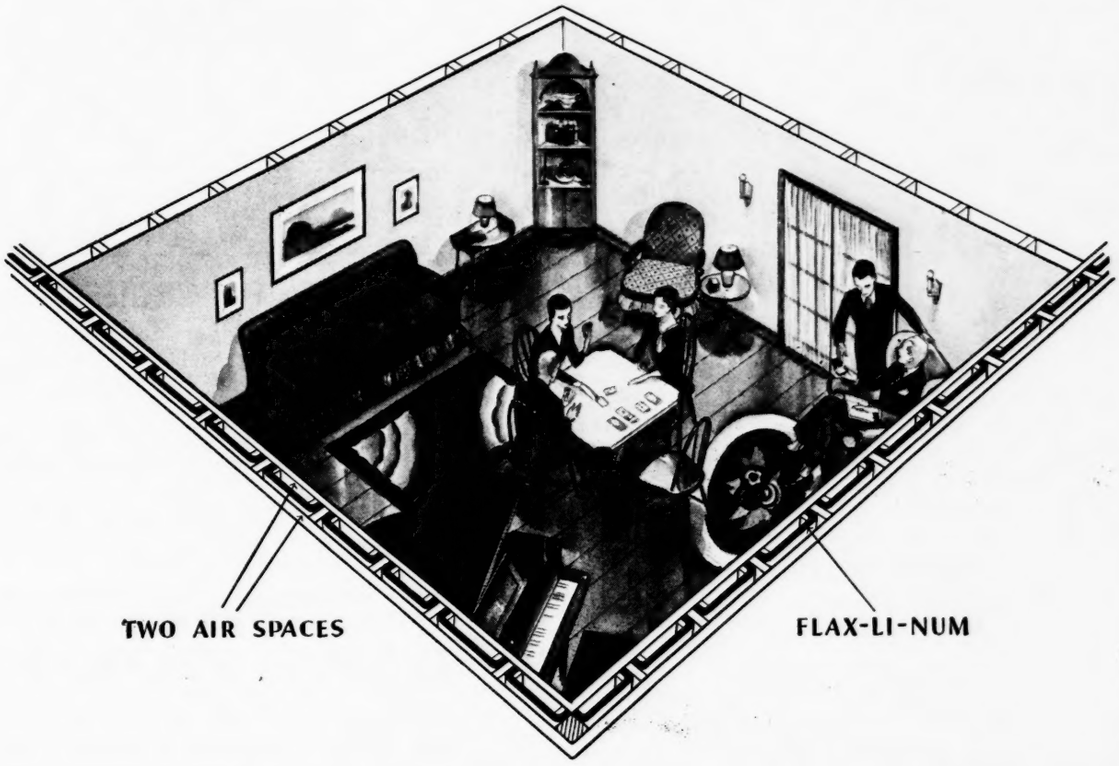
To State the Case Bluntly

Insulation is most Effective when used as Insulation



FLAX-LI-NUM, Through Its "Two-Air-Space" Method of Application, is 50% More Effective in Preventing Heat Leakage

INSULATING a home in such a way that the owner will receive *full benefit from the added layer of insulating material*, is a separate and distinct step in construction. To combine it with some other step, such as plaster base or sheathing means the forfeit of a certain amount of insulating value. The principle is clearly illustrated by the FLAX-LI-NUM "two-air-space" method of application which makes possible a 50% increase of efficiency merely by correct application.

FLAX-LI-NUM is a semi-rigid insulating material, designed to be applied between the studs in a wall. It divides the air space into two parts, adding the resistance of two air spaces instead of one. The insulating value of an ordinary air space more than about one inch in width is the equivalent of about ¼ inch of insulating material. Therefore, by its application, FLAX-LI-NUM adds the equivalent of an extra ¼ inch of insulation. According to the U. S. Bureau of Standards, "The addition of a half inch layer of insulation in the middle of the air space in a frame wall is, therefore, the equivalent of adding about a ¾ inch layer at some other place in the wall".

It is this extra 50% insulating value that has made FLAX-LI-NUM the outstanding home insulant when great comfort and fuel economy are the results desired. It is this extra 50% insulating value that proves the truth of the statement that insulation is most effective when used as insulation.

FLAX-LI-NUM is made in uniform sized sheets . . of ½ inch and full one inch thickness. So perfectly has it been developed that its correct application is simple and fast. It slips between the studs and is held permanently in place with binding strips. It will not break, tear, crack or otherwise lose its insulating value. There is no loss from waste material . . . In the FLAX-LI-NUM Manual are complete recommended specifications. It is a valuable piece of literature for your reference files. You may have a copy.

FLAX-LI-NUM INSULATING COMPANY
ST. PAUL, MINNESOTA

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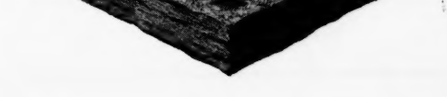
A CORRECT BUILDING INSULATION AND SOUND CONTROL MATERIAL



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St. Paul, Minnesota

Send me complete information about Flax-li-num.
Also facts about the "two-air-space" method.

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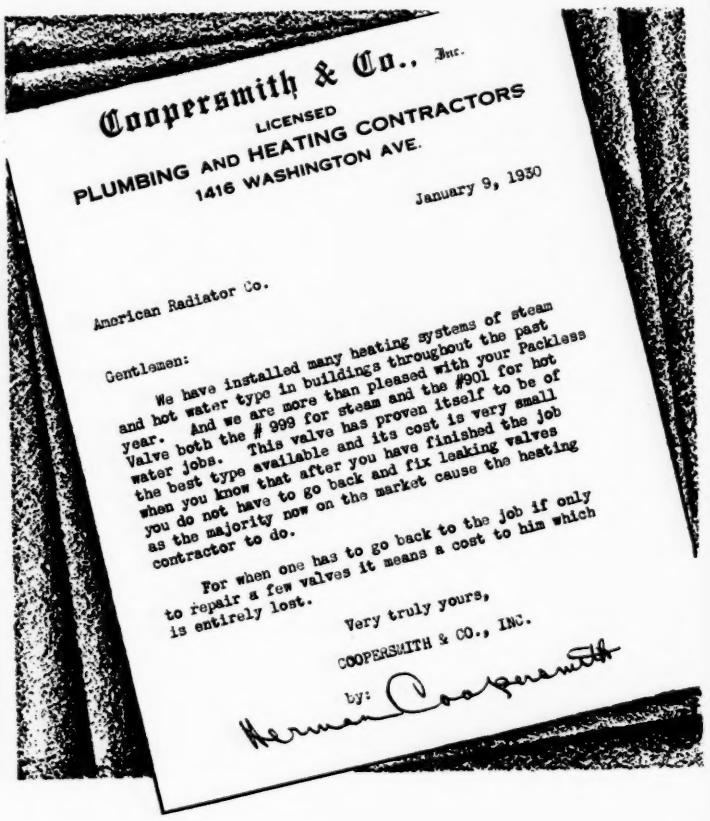
"You DON'T *have to* GO BACK *to* FIX LEAKING VALVES"



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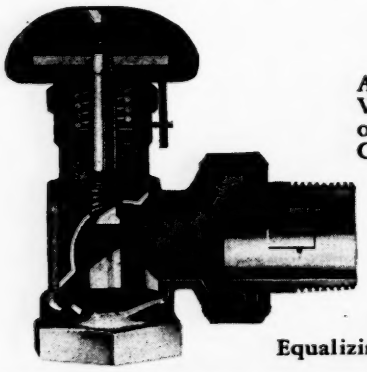

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A complete line of Packless Valves for steam, water, vapor or vacuum. Made in Angle, Corner, Globe and Gate patterns.

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In a Dozen Ways It Challenges

The Brownell Master welded steel heating boiler stands alone. In a dozen ways it challenges. In it boiler building craftsmanship is at its highest level. In it a dozen advanced features command attention—

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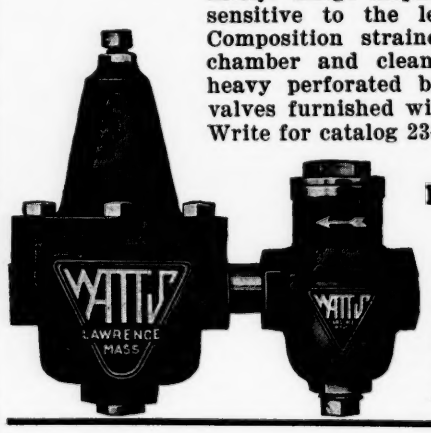

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The News Building fits in well. Its graceful lines are backed by substantial construction . . . especially the mechanical equipment. Here, time-tested and proven materials were specified by famed architects, engineers and contractors. Naturally, NATIONAL Pipe was chosen for the major part of the tubular requirements and, again, as in the Lexington Hotel of above group, NATIONAL Copper-Steel Pipe was used for the soil, waste, vent lines and rain leaders to resist atmospheric corrosion. NATIONAL Copper-Steel Pipe was also used in part of the drainage system of the Chrysler Building in this area. For complete information send for literature describing—

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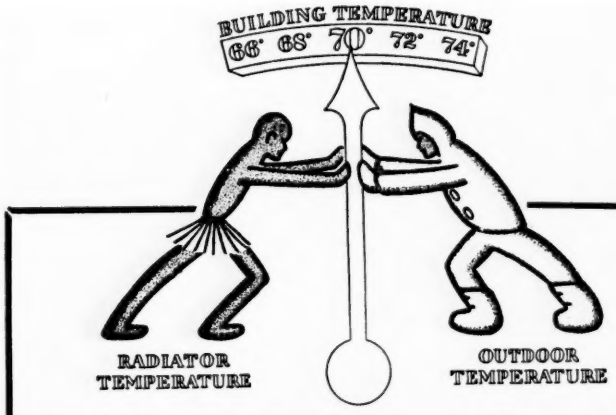

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The temperature of radiators governs heat supply. Outdoor temperature governs heat losses. *Balance the supply to exactly offset heat losses* and the building's temperature remains constant, no matter what the weather. That's exactly what the DUO-STAT does.

It controls the oil or gas burner or coal stoker directly by the radiator temperatures — the temperatures at which radiators are maintained being automatically changed, by the Duo-Stat according to the weather.

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WRITE for complete data and discounts, including a profusely illustrated Instruction Booklet with complete wiring diagrams for all types of installations

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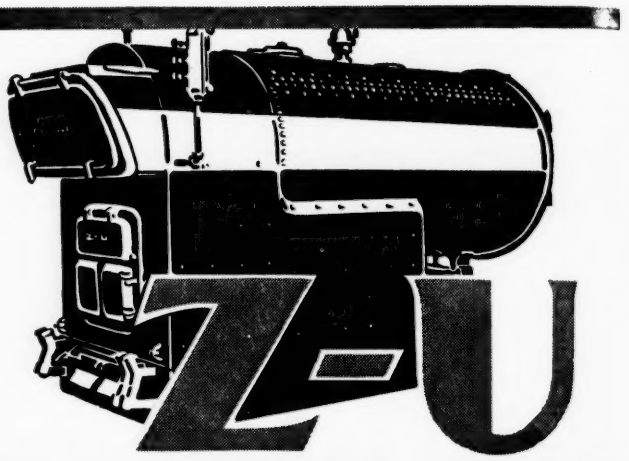

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4000 to 34,000 sq. ft. radiation

A radically different firebox boiler with patented features which assure

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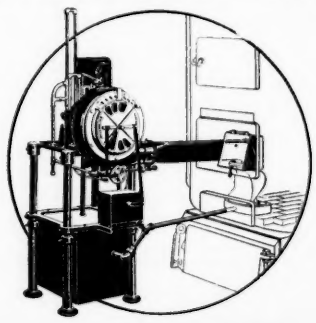

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a truly national prestige which did not "just happen"

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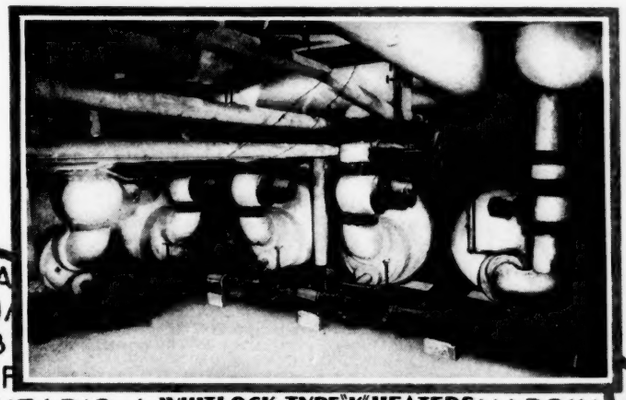
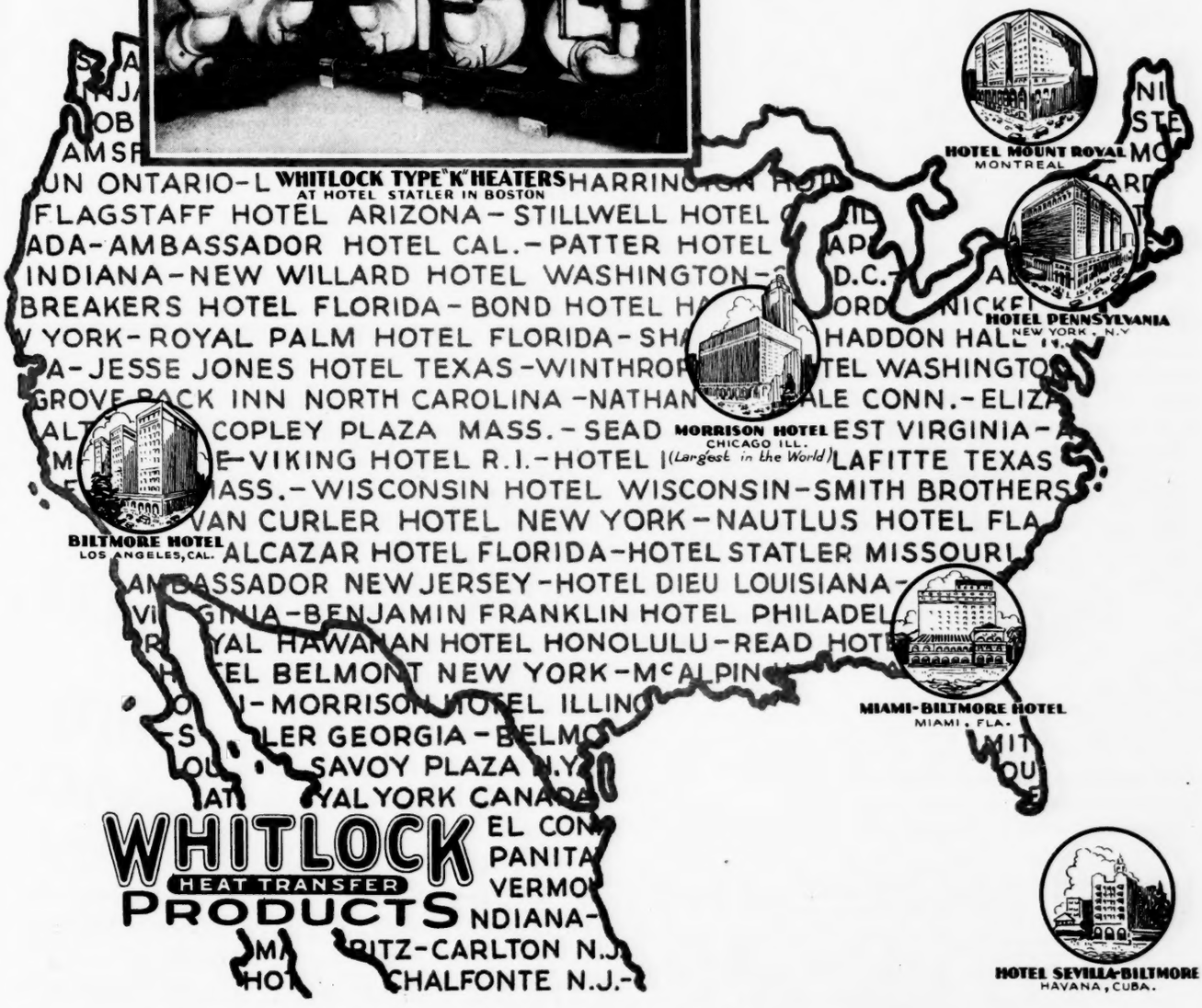


WHITLOCK TYPE "K" HEATERS AT HOTEL STATLER IN BOSTON

For information or engineering service on Whitlock Products consult the nearest Whitlock District Office or representative in New York, Boston, Philadelphia, Chicago, Detroit, Baltimore, Charlotte, Los Angeles, San Francisco and other principal cities.

Look under our name in your local telephone directory or drop a line to us at Hartford.



THE WHITLOCK COIL PIPE CO.

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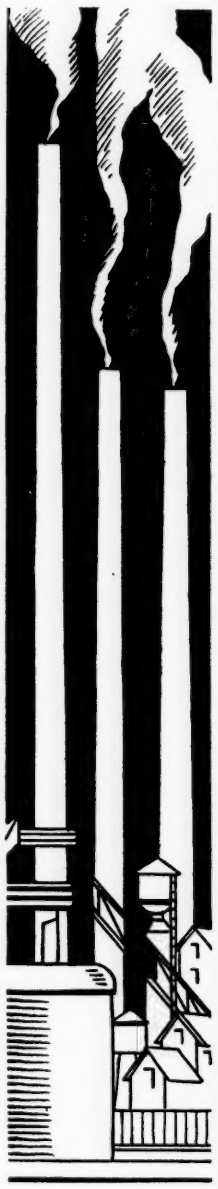
KNOWS THE FACTS



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The Fulton Sylphon Co., the world's largest exclusive manufacturers of temperature control instruments, for more than 25 years have worked with most of the world's outstanding engineers on their temperature control problems in practically all processes...and will be glad to give you the benefit of their wide experience. There is security in dealing with the leader of any industry, for leadership comes only after years of satisfactory service.

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Fairbanks Bronze Globe Valves

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Fig. .01

VULCABESTON VALVE DISCS average 60% greater mechanical strength.
VULCABESTON VALVE DISCS offer 30% greater resistance to crushing.
VULCABESTON VALVE DISCS contain 35% greater asbestos content.
VULCABESTON VALVE DISCS contain 85% non-combustible, non-fusible long fibre asbestos.

Available in Globe and Angle patterns also as Radiator Valves with Wood Wheel or Lock Shield for Steam or Hot Water Systems up to 150 pounds working pressure.

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WE are splendidly equipped to supply all types of finned tubing for copper radiation.

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THE G & O MANUFACTURING COMPANY
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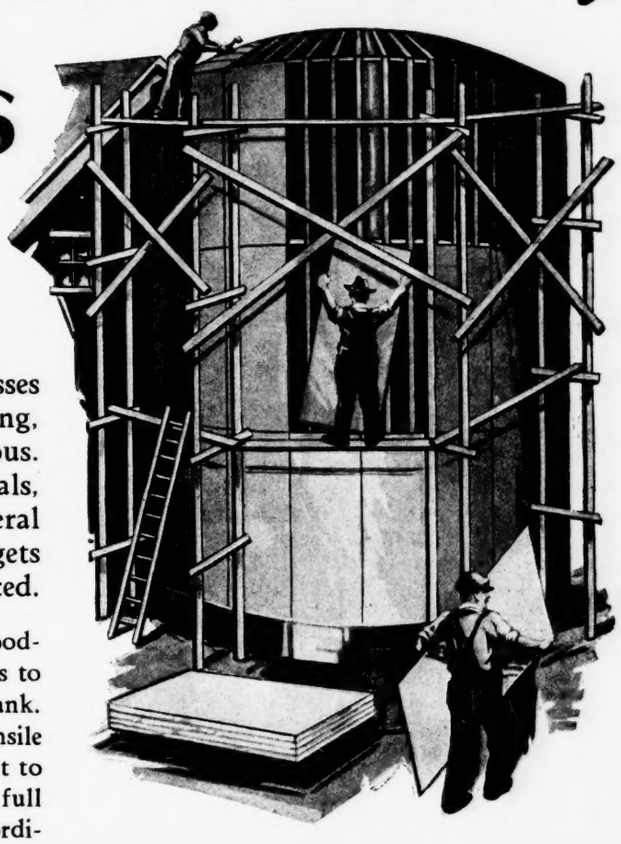
Established 1915
Manufacturers of the famous "G & O" Radiators for automotive vehicles

For Economy and Efficiency

Insulate STORAGE TANKS *with*

INSULITE

the Wood-Fiber Insulating Board



EVERY engineer knows that the monetary losses which occur through the evaporation, heating, or cooling of storage tank contents, are enormous. Increasing costs of crude and finished materials, mounting labor and fuel expenses, and a general economy now being practiced in industrial budgets demand that this form of economic waste be reduced.

Efficient insulation is the solution, and Insulite, the all wood-fiber insulating board, possesses the necessary requirements to insulate efficiently practically any type of storage tank. Insulite has rigidity, toughness, durability, great tensile strength, high water resisting properties, and is not subject to rot or disintegration. And remember . . . Insulite—a full ½ inch thick—is ***12½% more efficient*** insulation than ordinary 7/16 inch insulating boards.

Insulite when used as tank insulation is a real economy—especially so when applied to creosote, tar, hot water, syrup, and general make-up tanks because it means closer temperature control, increased production, and lower production costs.

Insulite is made from the tough fibers of spruce and other northern woods and is chemically treated to resist moisture. Permanence is an inherent characteristic of Insulite and it will indefinitely withstand the effects of moisture, wind, heat, cold, and the stress imposed upon it by expansion and contraction.

On your next storage tanks—if temperature control is desirable—use Insulite. It will mean greater profits, lower manufacturing costs, increased plant efficiency.

THE INSULITE COMPANY

(*A Backus-Brooks Industry*)
1200 Builders Exchange, Dept. 29C
Minneapolis, Minnesota

OFFICES IN ALL PRINCIPAL CITIES

INSULITE

the Wood-Fiber Insulating Board

WRITE FOR THIS BOOKLET

This booklet has been prepared by the Engineering Department of the Insulite Company to aid those who desire to reduce monetary and material wastes which result from uninsulated storage tanks. It also contains plans and specifications for the application of insulation on storage tanks. The Engineering Department of The Insulite Company is maintained to be of service to you and will gladly assist with any insulation problem you may have.

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Minneapolis, Minnesota.

Gentlemen: Please send me your booklet, "Insulite for Storage Tank Insulation." Also a sample of Insulite.

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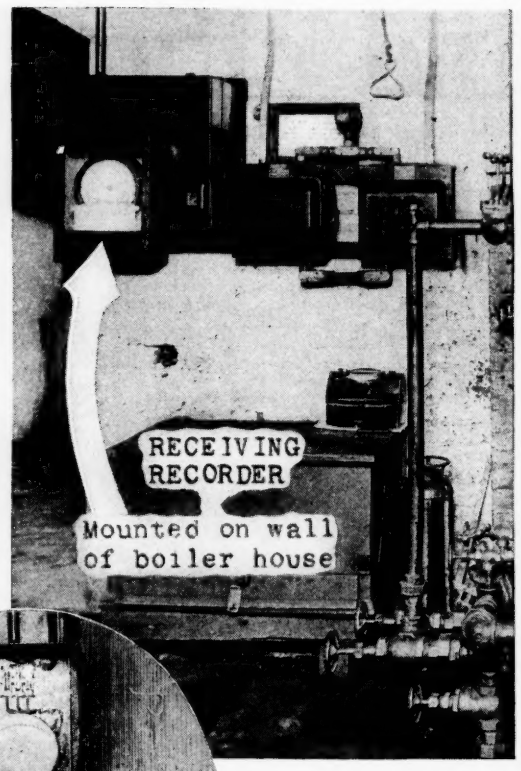
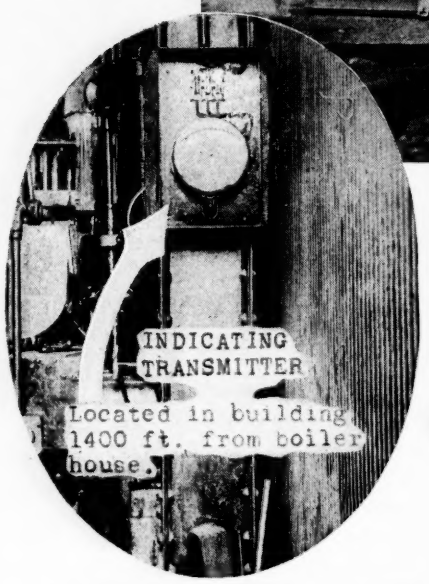
City ..... State .....

In a large Ohio Manufacturing plant, Bristol's Long Distance System indicates and transmits room temperature over a distance of 1400 ft. from machine and erecting building (see oval) to central boiler house (shown above). This arrangement enables boiler house fireman to keep machine and erecting building at a proper temperature at all times.





Remote Heat Control

with

BRISTOL'S Long Distance Transmitting and Recording System

Operating to transmit records of temperature, pressure, liquid levels, motion, speed, etc., from distant locations to a centralized point of control is the unique service rendered by Bristol's Long Distance System. This system can be installed to operate with equal facility over a distance of a few hundred feet or even up to several miles.

Used extensively in central heating stations, and in connection with heating plants of large industrial concerns, this Bristol's Equipment provides a constant survey of temperatures in all parts of the plant or system. Such information, being usually transmitted and continuously recorded in the central boiler house, enables firemen to better control boiler operation, with a resultant saving of steam and economy of fuel consumption.

Detailed description of Long Distance Equipment is interestingly presented in Catalog No. 1900. Send for a copy. There's no obligation.

The Bristol Company

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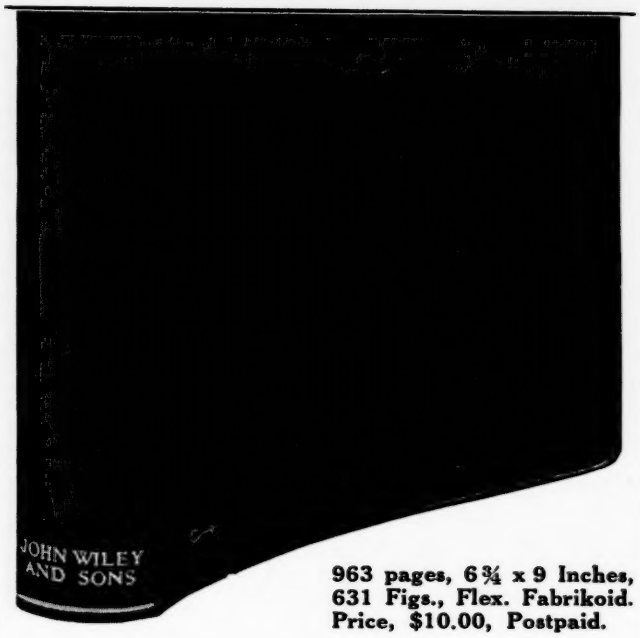
The New Harding and Willard's

Heating and Ventilation

Vol. 1 of Mechanical Equipment of Buildings



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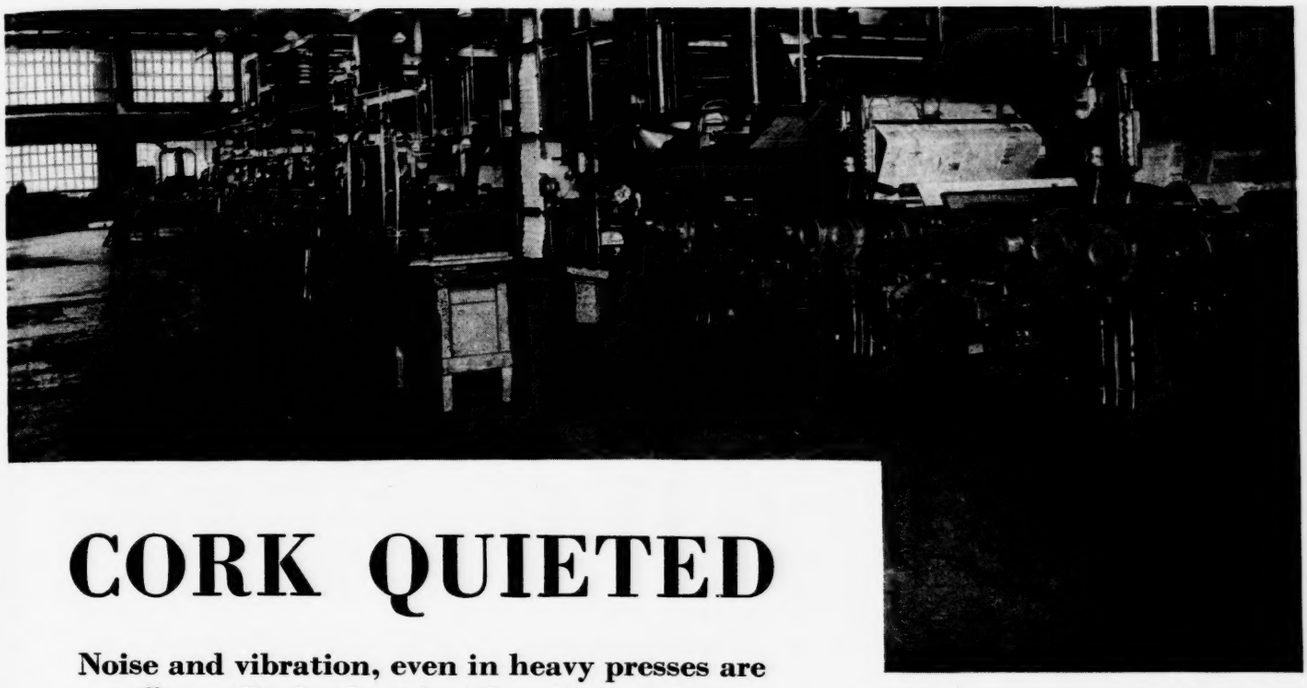

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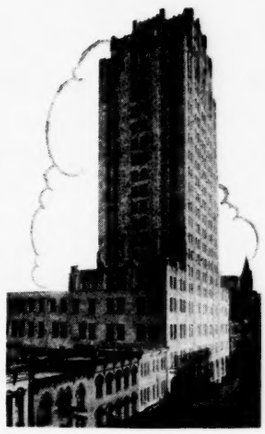
8,000 sq. ft. of Armstrong's Cork Machinery Isolation are installed under these heavy printing presses in the Star Newspaper Building.



Star Newspaper Building, Toronto, Ontario

FANS, pumps, engines, presses—all are alike in one respect: They make too much noise. But they differ in weight and operation and so require different treatment to deaden vibration. That is why Armstrong's Cork Machinery Isolation is made in different densities and thicknesses. The big presses of the Toronto "Star," for example, run smoothly and quietly on cushions of cork, Heavy Density, 1½ inches thick.

Armstrong's Cork Isolation, properly specified and used, will do the same completely effective job for any moving machine. There are three densities—light, medium, and heavy, and seven thicknesses, from one inch to six inches. With this wide range you can order the exact density and thickness of cork isolation suitable for the weight, speed, and action of any machine.

The use of Armstrong's Cork Machinery Isolation promotes more efficient operation. It protects machinery and the building structure from jar and vibration. It guards against excessive depreciation. And of special importance in hotels, apartments, and office buildings, it eliminates, or greatly reduces, the transmission of hum and vibration, and prevents complaints from tenants.

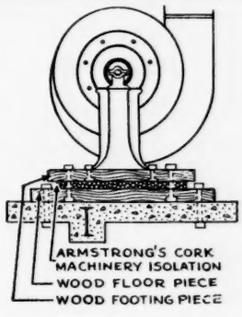
Armstrong's Cork Machinery Isolation is made of pure cork granules, compressed into boards and processed in such a way as to insure uniform density and quality. It is firm yet very resilient, and does not take a permanent "set." It is readily cut with a saw or knife. Easy to install. Costs only a few dollars.

All Armstrong's Cork Machinery Isolation is now plainly marked, in yellow, with the Circle A and the letters, "L", "M", and "H" to denote its density, Light, Medium, or Heavy.

Samples and full information furnished promptly on request. Write to Armstrong Cork & Insulation Company, 925 Concord Street, Lancaster, Pennsylvania.

Quiet These Machines

Armstrong's Cork Machinery Isolation is used for: air compressors, blowers, drill presses, drop hammers, elevator hoists, engines, fans, forging machines, machine tools, motors, printing presses, pumps, punching machines, refrigerating machines, vacuum cleaners, and similar apparatus.



Armstrong's Cork Machinery Isolation

Acid Fume Specialists!

INTRUST your problem of corrosive fume disposal to Duriron engineers, whose cooperation and counsel carry no obligation, and whose many years of experience in situations where corrosion is a factor should prove helpful in the selection of material.

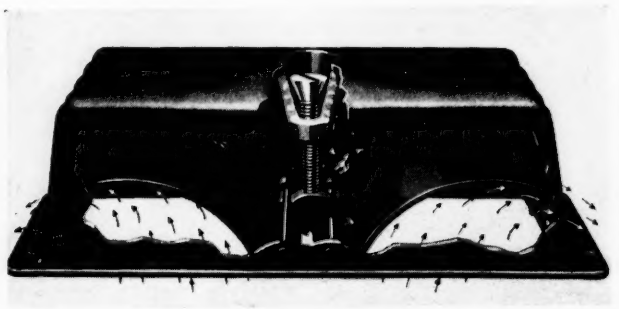
Duriron fans, with capacities of 50 to 5,000 cubic feet per minute, are unaffected by corrosive fumes or by condensate. They exhaust efficiently; last indefinitely, and operate with next to no attention.

Durimet acid-proof sheet fume ducts carry the gases from laboratory, battery station, and all industrial situations where corrosion is encountered, without deterioration.

With the materials of construction, and a broad background of experience, your acid fume handling problem becomes no problem at all. Sales engineering offices in 29 cities.

THE DURIRON COMPANY, INC.
DAYTON, OHIO
A Division of The Industrial Alloy Products Corporation

DURIRON
FOR ACID SERVICE



Pat. No. 1704661

HURRICANES and CYCLONES

may have their place in the scheme of things, but certainly not in the ventilation plans for theatres, auditoriums and assembly halls.

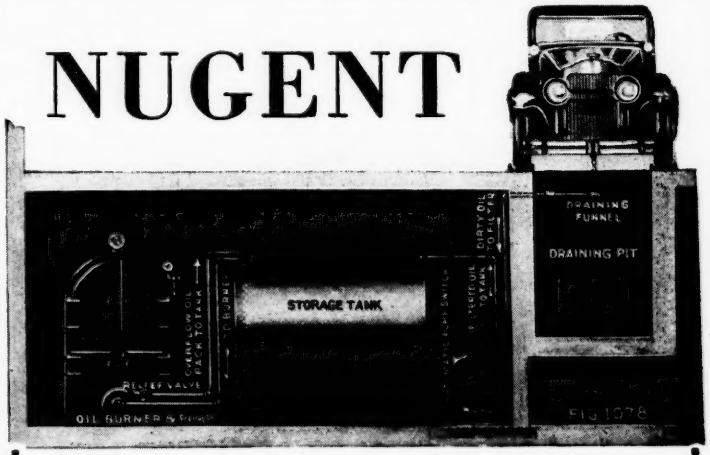
ENFLO DIFFUSER

will not only insure proper air distribution, but will present many advantages which have been recognized by architects and engineers, such as cast iron construction, operation of both dampers by one concealed screw, diffusion of air along the floor line by twin curved dampers and the economy of its installation on any type of floor.

Write for Illustrated Catalog.

VENTILATING PRODUCTS CO.
2800 Cottage Grove Ave., Chicago, Ill.

NUGENT



Seventy Thousand Garages

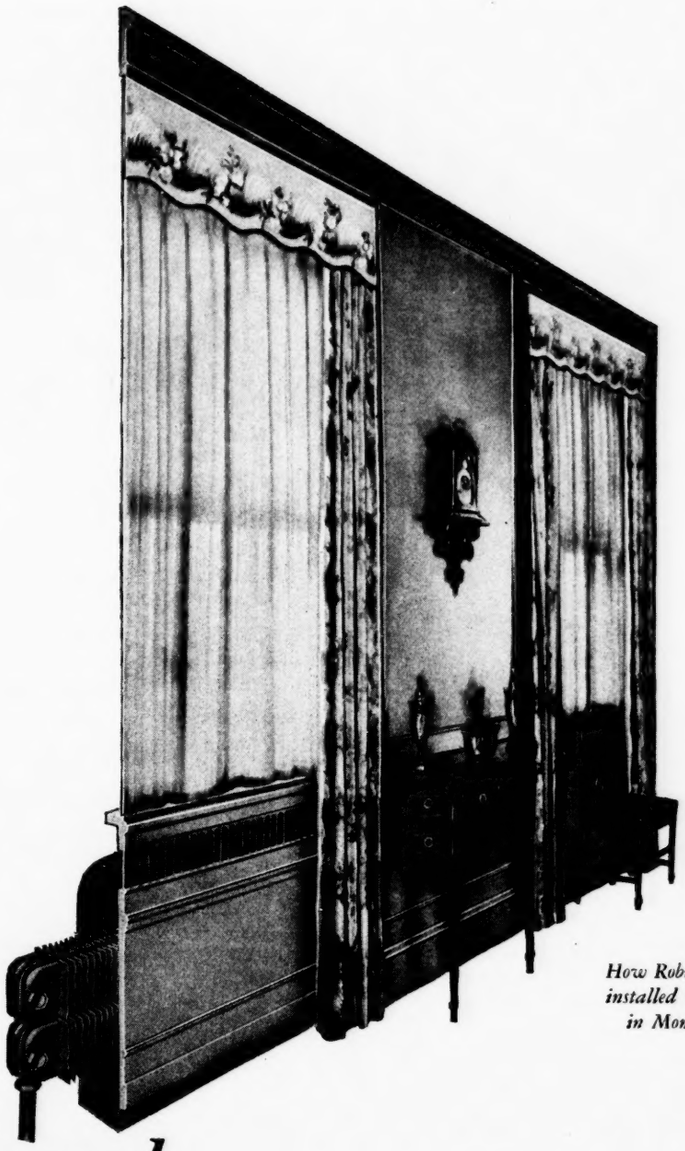
are doing an active business in this country, —nearly one third of that number handle sufficient crank-case oil to utilize for heating fuel.

Heat Without Cost

The Nugent Crank Case Fuel Oil Filter operates automatically in accordance with the demands of the burner. The waste crank-case oil is prepared and utilized at practically no cost. There is an excellent opportunity for dealers to sell this filtering equipment as well as oil burners to garages.

Write Today For Details

Wm. W. Nugent and Company
409 North Hermitage Ave., CHICAGO, ILL.



How Robras 20-20 were installed in a residence in Montclair, N. J.

Discovered . . . a place for the radiator!

And, as it happens, not a very big place. Nor a very prominent one, either.

For Robras 20-20 Radiators go into the walls, out of sight, out of the way. **They fit into *any* space *any*where, four inches deep!**

But that's just from the customer's point of view. From your own point of view:

They're 20% the size and 20% the weight of equal cast-iron radiation. Two men can install four or five times as many in a day. They're far easier to handle. The profit possibilities are so much greater.

And, of course, the prestige of offering something new and better goes with every Robras 20-20 job . . . Let's tell you more about it. Send us your name and address—and we'll send you the data and price lists. ROBRAS 20-20

ROME BRASS RADIATOR
CORPORATION

ROME BRASS RADIATOR CORPORATION, ONE EAST FORTY-SECOND STREET, NEW YORK, N. Y.

THERMO SYPHON TRAPS

are constructed to meet the essential demands for the proper operation of the heating system by keeping the water level up to the safety line. This factor is the certain guarantee of extended years of life for your boiler.

Send for our Bulletin 16 H-V Giving full Details.

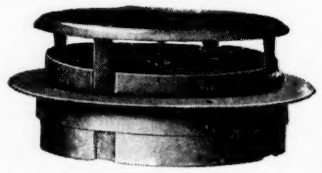
Regardless of pressure or vacuum, the THERMO SYPHON TRAP will maintain the water level because all condensation is returned. This is definite prevention of air bound or water logged conditions and resultant burning or cracking of the boilers.

THERMO SYPHON TRAP

The Thermo Syphon Trap safeguards all types of vapor and atmospheric heating systems .....

We solicit your correspondence.

LYTTON MANUFACTURING CORPORATION
FRANKLIN, VIRGINIA



for Strength and Convenience

AEROVALVE **Steel**

MUSHROOM AIR DIFFUSER

A much superior product than cast iron mushrooms for 2 good reasons—it is twice as strong and only weighs half as much. Aerovalve Mushrooms are made of durable rolled STEEL. Unlike cast iron mushrooms, they WILL NOT BREAK. Their light weight makes for quick, easy installing.

For detail and prices, write to:

Knowles Mushroom Ventilator Co.

Originators of the Mushroom and makers of the "Nu-Notch" Mushroom and "Disc-Loc" Gallery Riser Vents.

41 No. Moore St., NEW YORK CITY

THE KAINER PRESSURE GOVERNOR
The KAINER PRESSURE GOVERNOR
For Hot Water Heating Systems
Reduces the cost of a hot water layout.
Eliminates expansion tank and fittings (with its danger of freezing and overflowing).
Simplifies installation—makes a better job.
Saves your time and your customers' money.
Increases your profits and builds good will.
Write us for full information
KAINER & COMPANY CHICAGO
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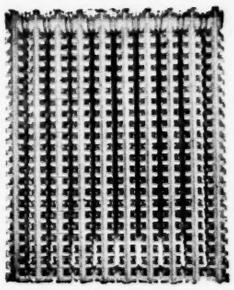
VENTO
CAST IRON HEATERS

for this
Magnificent Hotel
●

ONLY the best was good enough for this new hotel in New York's exclusive Plaza district, and 11,000 feet of Vento was installed. Vento heaters are made of Cast Iron—so they last as long as the building itself. That is just one of the reasons why engineers of modern buildings are installing Vento wherever indirect heating is desired.



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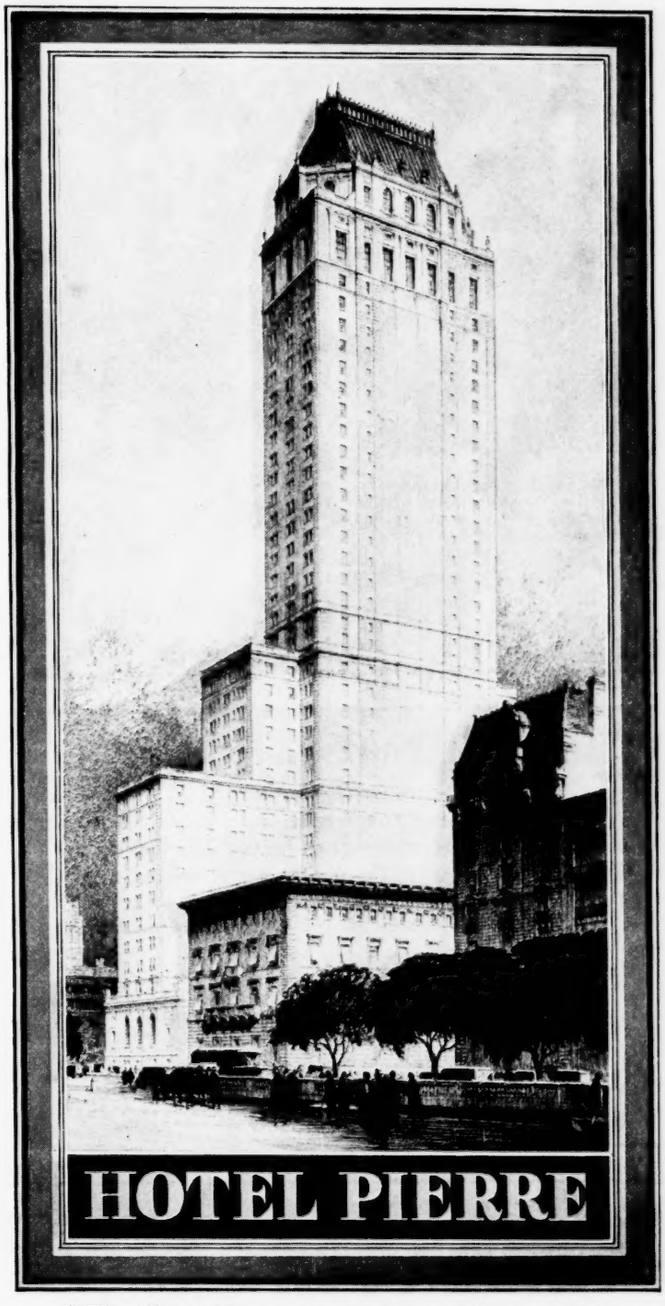
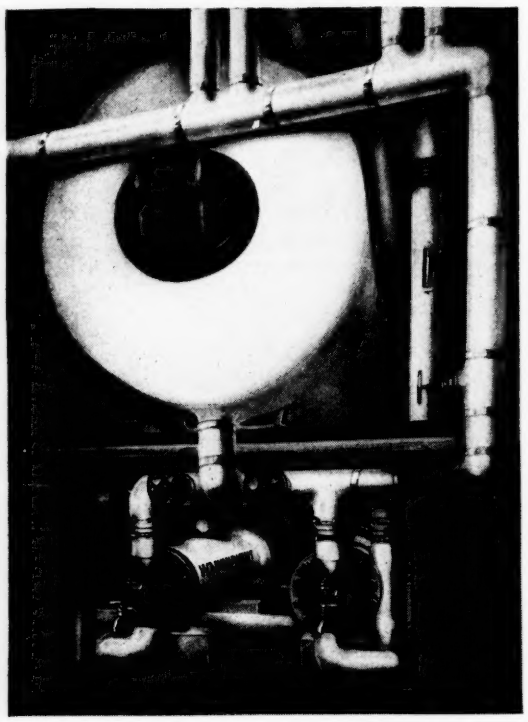


●The Hotel Pierre is another addition to the group of modern buildings in the New York Society Center—Central Park Plaza.

AMERICAN RADIATOR COMPANY
40 WEST 40TH ST., NEW YORK • 816 SO. MICHIGAN AVE., CHICAGO



Wainwright hot water heaters may be used with or without storage tanks. The heaters are built in vertical or horizontal types and installed as space conditions permit.

A Reliable Hot Water Supply

Two Wainwright heaters, with storage tank above, as shown in the accompanying photograph, are used to supply hot water in a large institution. This service includes supplying the kitchens, laundry, showers and a swimming pool with hot water.

The Wainwright heaters are of the floating head, instantaneous type. Either live or exhaust steam may be used for heating the water.

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Foreign Associates:—
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FOSTER WHEELER

CHACE THERMOSTATIC METAL

"It bends with the heat"

A most accurate, consistent, and durable bi-metal for temperature responsive devices.
For Low and High Temperature Applications.
Type No. 1800 Bi-metal for temperatures 0 to 300 F.
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Write for sample and description, giving as much information as possible regarding application.

Manufactured by
W. M. CHACE VALVE COMPANY
1600 Beard Ave., DETROIT, MICHIGAN

O.K.

Before any piece of heat transfer equipment leaves the O. E. Frank factory, it must be O. K. in every respect. Design, workmanship, construction and materials must be of the very best. We guarantee it. This policy has had the O. K. of exacting customers and engineers in every city of America.

HEATERS
RECLAIMERS
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O. E. FRANK HEATER & ENGINEERING CO., Inc.
20 Milburn Street BUFFALO, N. Y.

Specify S & K VENTURI REDUCING VALVES
for district heating plants

Motor operated flow regulating valve, expansion nozzle for pressure reduction, automatic control for valve motor. Built for low, medium or high pressures.

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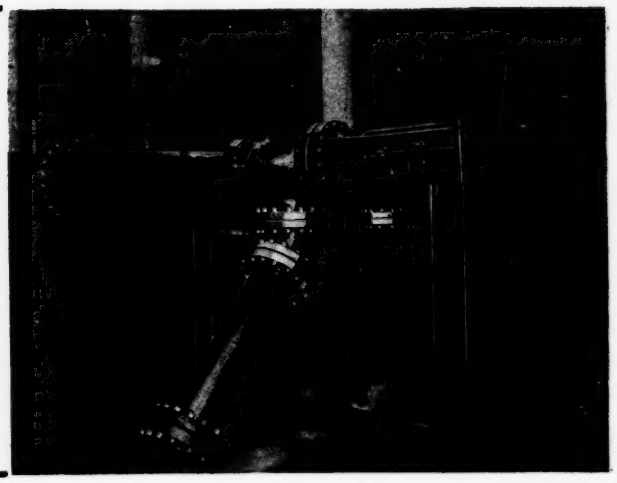
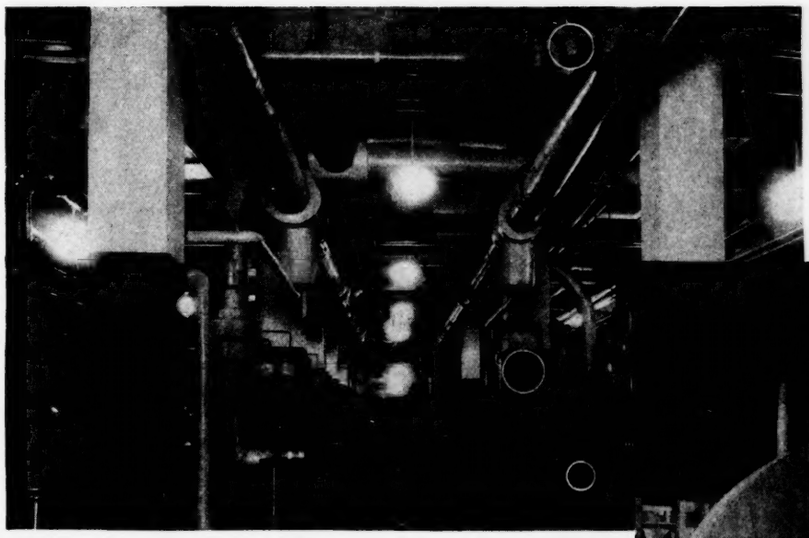




At left: Armstrong Compound and No. 2 traps in Royal York Hotel, Toronto, Ont. The compound type takes care of pulsating loads. Below: Armstrong Trap protecting a steam engine driving a blower

A *foolproof* steam trap for heating equipment

SINCE their operation is practically foolproof, Armstrong inverted bucket steam traps enable you to guarantee perfect condensate drainage of unit heaters, mains, engines, and other heating and conditioning accessories at all times. It is not unusual for Armstrongs to work years with no attention whatsoever.

These traps are small in size, with large capacity. They cannot airbind. Scum and sediment are discharged with condensate; the action makes them self-scrubbing. The radiation loss is small and they do not leak steam or wiredraw.

We are glad to co-operate with engineers and architects in determining the proper sizes of traps on heating jobs, without obligation. Detailed data on traps and applications sent on request.

Armstrong Traps are furnished in sizes and types for pressures to 1350lbs. and any degree superheat

ARMSTRONG MACHINE WORKS

346 Maple Street, Three Rivers, Michigan

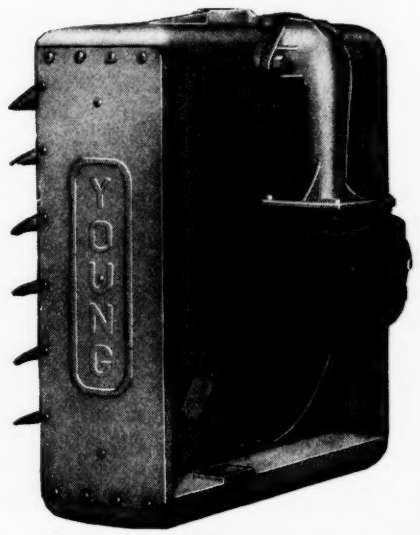
District Representatives in 42 Cities

H&V3—Gray

Comfortable Heating

The Young Unit Heater will deliver more cubic feet per minute and more B. T. U's. than any unit heater of its size and weight. This fact, combined with low final air temperature, results in a better distribution of heated air over a larger area and maintains a more comfortable temperature in the working zone.

These ideal conditions are due to the construction of the heating element. It is composed of flat vertical copper tubes to which are fused rows of flat copper fins slanting slightly downward, permitting the deflectors to direct the air downward without the usual backlash and friction that otherwise occurs when the air hits the deflector. Our current bulletin gives complete details—send for it.



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Young Unit Heaters

Built for Endurance and Maximum Performance

Young Quality

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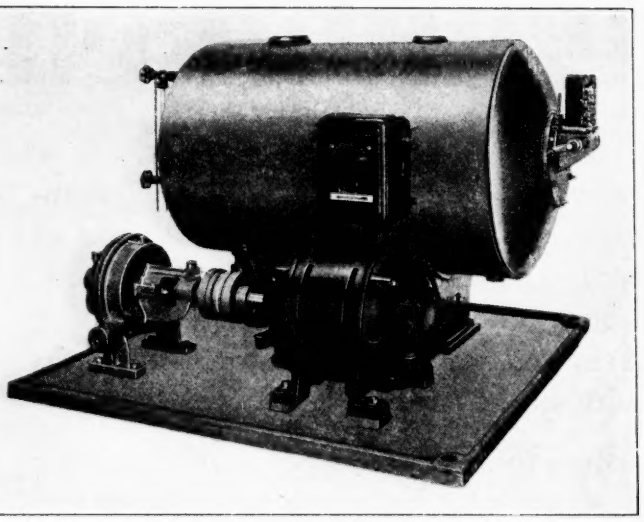


EAGAN CONDENSATION UNITS

Individually built to meet YOUR requirements or specifications. Any size, capacity or discharge pressure. Single or Duplex.

Inquiries for Representation Solicited

WALTER H. EAGAN AND CO.
1612 Vine Street, PHILADELPHIA, PA.

New STAT-AMATIC CATALOG

Tells how Stat-Amatic is solving unlimited problems of heat control and temperature regulation including its great value in connection with Unit Heaters.

You should have this catalog HV3.

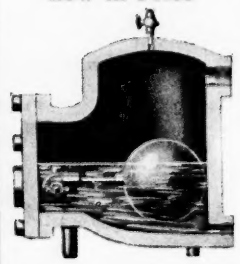
Stat-Amatic Intrument & Appliance Co.
HARTFORD, CONN.

END YOUR TRAP TROUBLES NOW!

Order a **WANSTALL STEAM TRAP** on our **60 DAYS FREE TRIAL**

We pay freight charges if not satisfactory.

Low in Price



Only one moving part. Valves are self-grinding and renewable in few minutes. Guaranteed for 3 years.

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Heat Transfer Products, Inc.
Division of
AMERICAN LOCOMOTIVE COMPANY
30 Church Street—New York

An Installation Service Department

To Help You Get Best Results

If you run into a tough installation problem .... if you need advice on the proper location of a fan .... frequency of air change, etc., call on our engineers for help.

We are here to serve you and are glad to work with you. Just send us a rough diagram of your layout showing inlets and possible outlets. Tell us what you can about the existing foul air conditions and what results are desired. We will give you a prompt, complete recommendation on how to plan your installations.

Emerson Exhaust Fans with their famous Emerson Motor are available in sizes from 12 to 36 inches. Their performance sets a high standard for quiet, efficient, attentionless operation.

May we send Bulletin 3519 containing full data?

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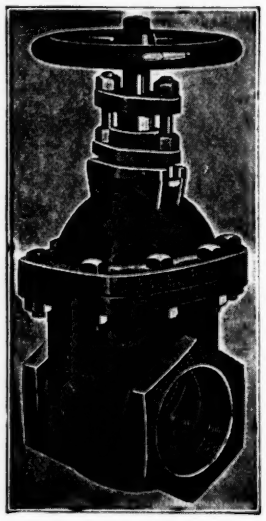
EMERSON
EXHAUST FANS

Made by the Makers of Emerson 1-30 to 2 h. p. motors

IRON BODY GATE VALVES



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HUB END STYLES

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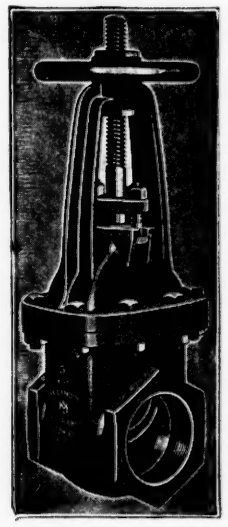

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Modulation Vapor and Vacuum Heating Systems of Proven Quality

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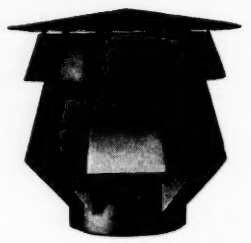
Specify **ÆOLUS IMPROVED VENTILATORS**



Aeolus Improved Double Syphon Ventilators give 10% more power than formerly, according to Armour Institute Tests.

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Industrial Division of Paul Dickinson, Inc.
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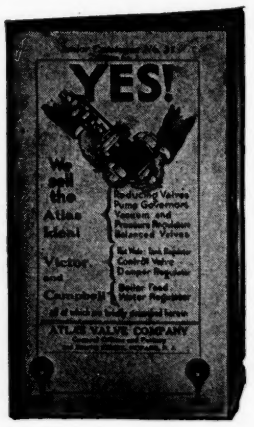

Keep a Copy in Your Files

Every Heating and Ventilating Engineer should keep a copy of this Atlas Junior Catalog No. 21 in his files. Check off those items below in which you are interested, mail to us, and you will receive this catalog, prices, and whatever you may need in the way of information on any Atlas product.

- ☐ Reducing Valves
- ☐ Temperature Regulators
- ☐ Damper Regulators
- ☐ Pump Governors
- ☐ Float Valves
- ☐ Swing Joint Fittings
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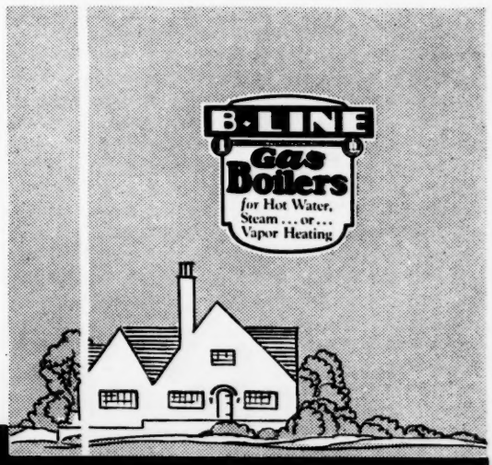

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When you handle B-Line Boilers you've got something more to sell than a bundle of iron and crate of controls . . . you're selling heat!

And it's the HEAT you can GUARANTEE . . . not just parts.

Tell your customers that B-Line Boilers are guaranteed on a money back basis to heat their homes to their satisfaction. We back you up on that.

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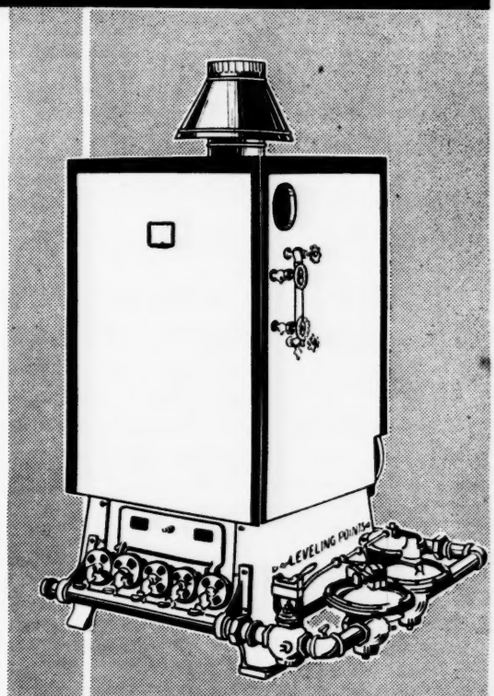
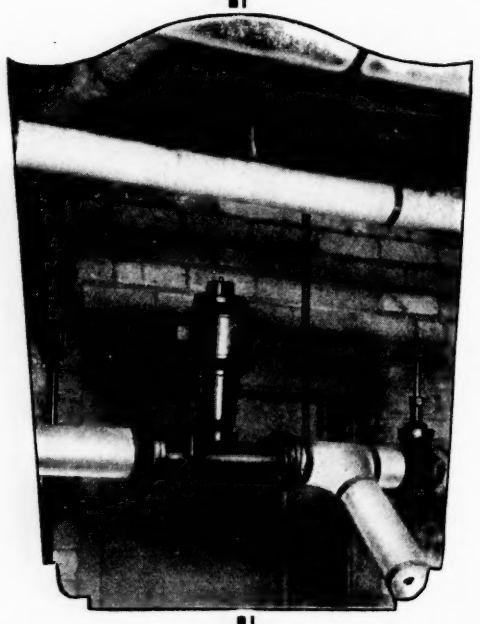
These are simple selling truths substantiated by records, statistics, impartial tests and what is more important . . . the experience of thousands of B-Line users.

Armed with these selling weapons, you have the edge on any competitor you may meet. Use them and you'll find B-Line Boilers remarkably easy to sell.



B-LINE BOILER COMPANY
CLEVELAND, OHIO



NOW... Make Real Friends and Real Profits Curing "Sick" Hot Water Jobs..

MID-WINTER is one of the best times of the year for *your* HYDROLATOR profits. You'll find the owners of "sick" hot water systems in a most receptive attitude toward the HYDROLATOR at this time . . . when they're cold and uncomfortable.

Forces Rapid Circulation

The HYDROLATOR, by means of a centrifugal pump, drives the water through the system several times faster than ordinary thermal circulation. Also, by means of an exclusive check valve feature, it overcomes traps and excessive pipe restrictions.

Saves Fuel

The HYDROLATOR saves enough fuel in one or two seasons to pay back to the owner its cost of installation.

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"Extra Heavy" Tube for Oil Burner Installations. Special Tubing to order. Parts fabricated to specifications.

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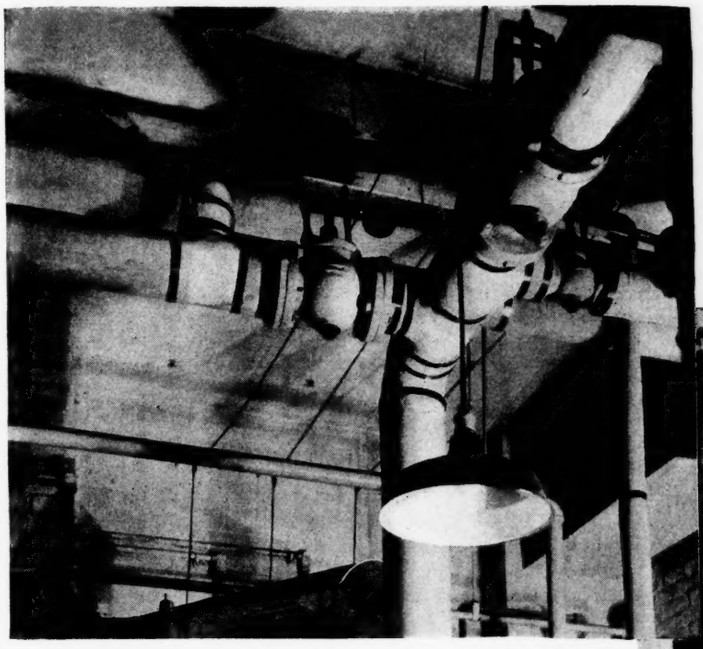
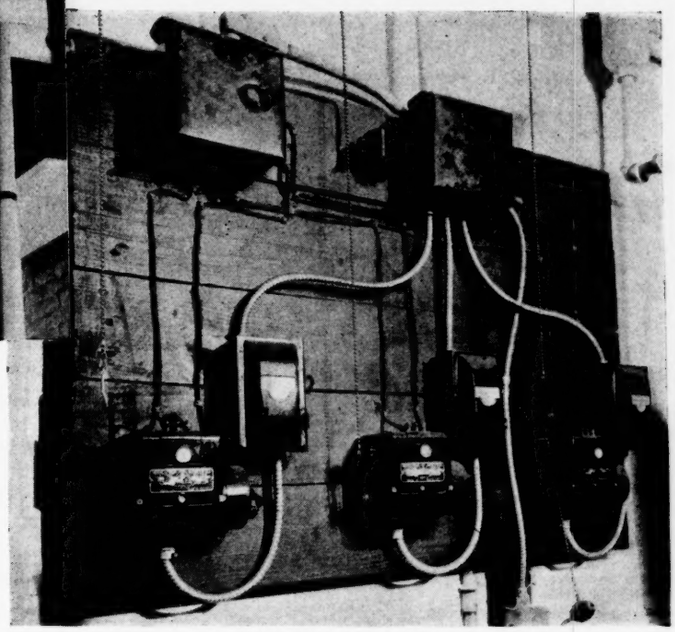
Bulletin 55—The Function of Ozone in Water Purification.

Factory and Sales Office: SCOTTDALE, PENNA.





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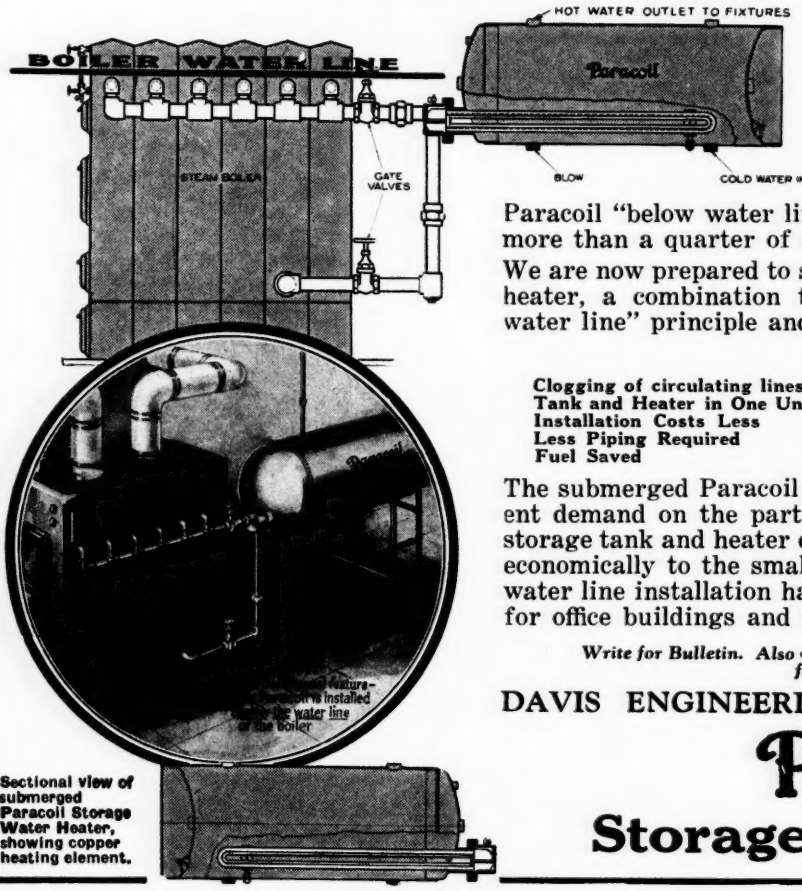
The submerged type storage Water Heater



Sectional view of submerged Paracoil Storage Water Heater, showing copper heating element.

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Paracoil "below water line" indirect heaters have been approved by more than a quarter of a million users.

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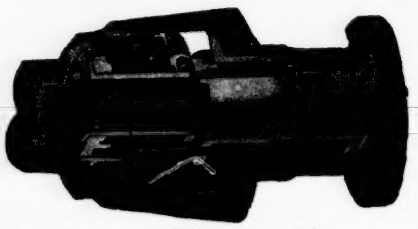

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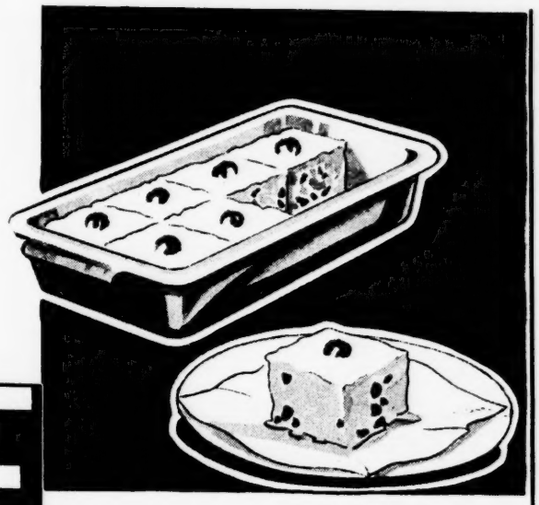

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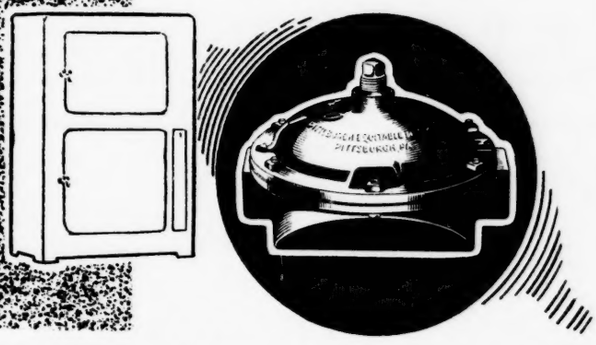

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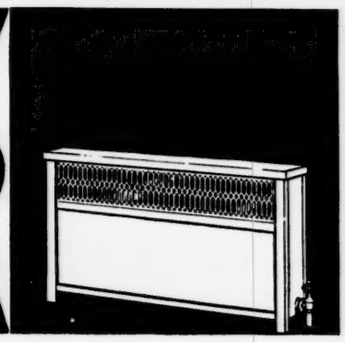

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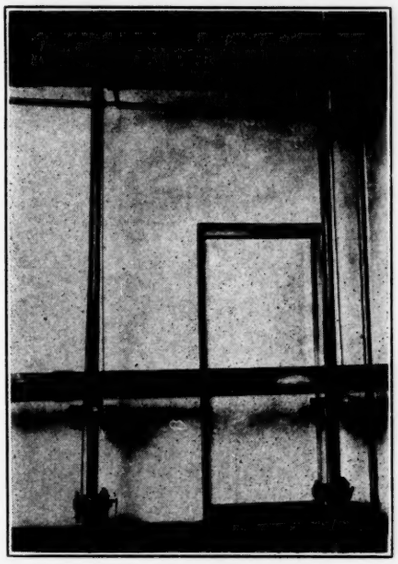

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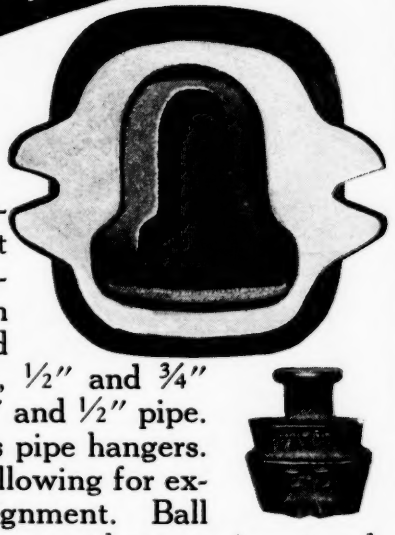

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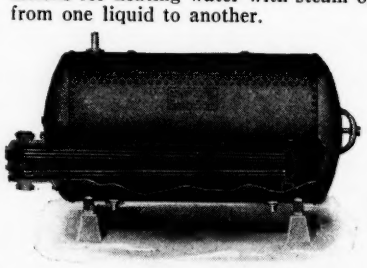

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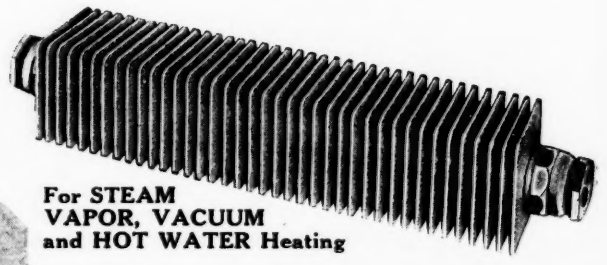

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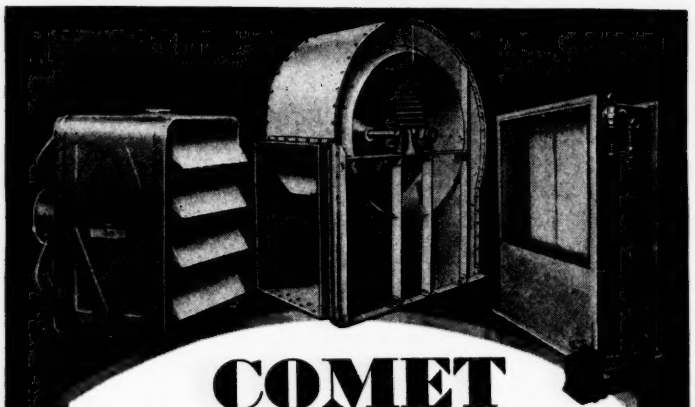

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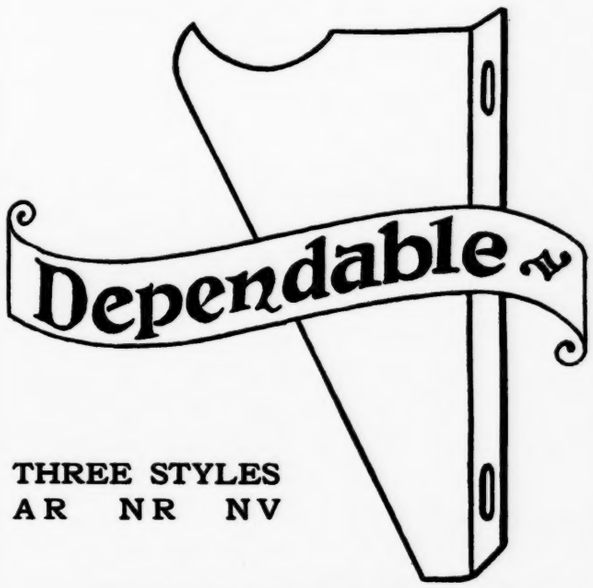

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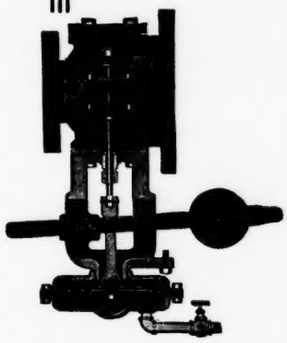

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Davis Engineering Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

DRAFT APPLIANCES, MECHANICAL
Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
National Regulator Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

DRYING SYSTEMS
(See Air Cooling & Drying Systems).

DUST COLLECTING SYSTEMS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Midwest Mfg. Co., Bradford, Pa.
Skinner Bros. Mfg. Co., St. Louis, Mo.

DUST COLLECTORS
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Skinner Bros. Mfg. Co., St. Louis, Mo
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

ENGINES, STEAM
Brownell Co., The, Dayton, Ohio.
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, O.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EQUALIZING LOOPS
Hoffman Specialty Co., New York.
Sarco Co., Inc., New York.

EVAPORATORS, BOILER FEED MAKE-UP
Buffalo Forge Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Foster Wheeler Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

EXHAUST HEADS
Aeolus Dickinson, Chicago, Ill.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swartwout Co., Cleveland, Ohio.

EXHAUST SYSTEMS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

EXHAUST SYSTEMS, ACID
Duriron Co., Inc., The, Dayton, O.

EXPANSION JOINTS
Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., North Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Central Station Steam Co., Detroit, Mich.
Crane Co., Chicago, Ill.
Foster Wheeler Corp., New York.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Walworth Co., New York.
Webster & Co., Warren, Camden, N. J

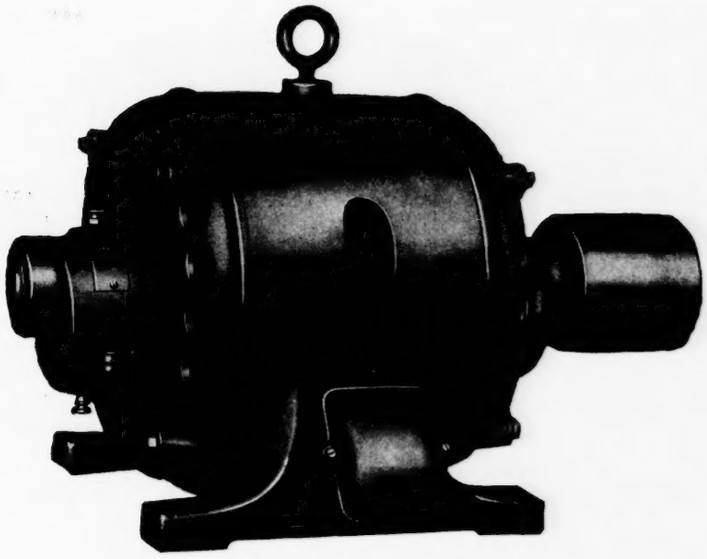
FANS, CENTRIFUGAL
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

FANS, DISC
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

FANS, PROPELLER
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Emerson Electric Mfg. Co., St. Louis, Mo.
Hartzell Propeller Co., Piqua, Ohio.
Modine Mfg. Co., Racine, Wis.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.
Young Radiator Co., Racine, Wis.

FANS, MULTI-BLADE
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

FANS, STEEL PLATE
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.



20 Horse Power Century Type SC
Squirrel Cage Induction 3 and 2 Phase Motor

Continuity of Service

The Real Test of Any Motor

The "Keep a-Running" ability of Century Type SC Squirrel Cage Induction 3 and 2 Phase Motors is of decided importance to users and manufacturers of motor-driven apparatus . . . . These motors will start against heavy static loads—will withstand the shocks common to reciprocating equipment and the stress and pounding of chain and gear drives . . . . The rotors are practically indestructible—they run cool because the sheet-steel ventilating fans assure a continuous air flow through the motor.

Century 250 Horse Power 60 Cycle 440 Volt 1800 R. P. M. 3-Phase Squirrel Cage Induction Motor.

Built in standard sizes from ¼ to 250 horse power, they are ideally suited for a wide range of general-purpose and heavy-duty applications.

CENTURY ELECTRIC COMPANY
1806 Pine St. St. Louis, Mo.

40 U. S. and Canadian Stock Points and more than 75 outside thereof.

Century MOTORS

"THEY KEEP A-RUNNING"

Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

FEEDERS, BOILER

Crane Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Walworth Co., New York.
Watts Regulator Co., Lawrence, Mass.

FILTERS, CRANKCASE, OIL

Nugent & Co., W. W., Chicago, Ill.

FILTERS, (AERATING)

Davis Engineering Corp., New York.

FILTERS, FEED-WATER

Davis Engineering Corp., New York.

FITTINGS, ACID RESISTING

Crane Co., Chicago, Ill.
Duriron Co., Inc., The, Dayton, O.

FITTINGS, COMPRESSION PIPE

Nugent & Co., W. W., Chicago, Ill.

FITTINGS, PIPE, FLANGED

Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Walworth Co., New York.

FITTINGS, PIPE, SCREWED

Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Walworth Co., New York.

FLANGES

Crane Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Walworth Co., New York.

GAS BURNERS (CONVERSION TYPE)

Cleveland Gas Burner & Appliance Co., Cleveland, Ohio.
Roberts-Gordon Appliance Co., Buffalo, N. Y.
Sweet & Doyle Co., Troy, New York.

GASKETS, ASBESTOS

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville Corp., New York, N. Y.

GASKETS, METALLIC

Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GASKETS, RUBBER

Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GAUGE BOARDS

Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

GAUGE GLASSES

Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GAUGES, ALTITUDE

American Radiator Co., Buffalo, N. Y.
Bristol Co., The, Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
National Radiator Corp., Johnstown, Pa.

GAUGES, COMBINATION PRESSURE AND ALTITUDE

Bristol Co., Waterbury, Conn.
Marsh, Jas. P., Chicago, Ill.
Foxboro Co., The, Foxboro, Mass.
Bristol Co., Waterbury, Conn.
Mercoid Corp., Chicago, Ill.

GAUGES, DRAFT

Bristol Co., The, Waterbury, Conn.
Foxboro, Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

GAUGES, HYDRAULIC

Bristol Co., The, Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

GAUGES, OUNCE GRADUATED

Bristol, Co., The, Waterbury, Conn.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.

GAUGES, PRESSURE

American Radiator Co., Buffalo, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sterling Engineering Co., Milwaukee, Wis.

GAUGES, TANK

GAUGES, VACUUM

American Radiator Co., Buffalo, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., Waterbury, Conn.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

GAUGES, VACUUM (COMPOUND)

Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

GAUGES, VOLUME

Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

GAUGES, WATER

Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
The Stack Heater Co., Boston, Mass.
Walworth Co., New York.

GENERATOR COOLING SYSTEMS

Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Reed Air Filter Co., Louisville, Ky.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

GOVERNORS (PUMP)

Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Watts Regulator Co., Lawrence, Mass.
Webster & Co., Warren, Camden, N. J.

GRATES, DUMPING

Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, ROCKING

Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING

Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING AND DUMPING

Frost Mfg. Co., Galesburg, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING, CIRCULAR

Fitzgibbons Boiler Co., Inc., New York.

GRATES, STATIONARY

Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEAT CABINETS

(See Radiators, Cabinet and Concealed)

HEATERS, AIR, FAN SYSTEM

Aerofin Corp., Newark, N. J.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Dwyer Equipment Co., Chicago, Ill.
Modine Mfg Co., Racine, Wis.
New York Blower Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Thermal Units Co., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.
Wing Mfg. Co., L. J., New York.
Young Radiator Co., Racine, Wis.

HEATERS, DOMESTIC WATER

Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Foster Wheeler Corp., New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill
McDermott Water Heaters, Inc., New York, N. Y.
Modine Mfg. Co., Racine, Wis.
Monitor Boiler Co., Philadelphia, Pa.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.
Weil-McLain Co., Chicago, Ill.
Whitlock Coil Pipe Co., Hartford, Conn

HEATERS, FEED WATER, (CLOSED)

Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Foster Wheeler Corp., New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Stanwood Corp., Cincinnati, Ohio.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER (OPEN)

Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEATERS, FUEL-OIL

Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Electrol, Inc., St. Louis, Mo.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, UNIT

Air-Way Electric Appliance Corp., Toledo, Ohio.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Dwyer Equipment Co., Chicago, Ill.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Thermal Units Co., Chicago, Ill.
Wing Mfg. Co., L. J., New York.
Wolverine Tube Co., Detroit, Mich.
Young Radiator Co., Racine, Wis.

HEATERS, UNIT GAS FIRED

General Gas Light Co., Kalamazoo, Mich.

HEATING SYSTEMS, GAS

Roberts-Gordon Appliance Co., Buffalo,

HEATING SYSTEMS, VACUUM

Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago Ill.
McAlear Mfg. Co., Chicago, Ill
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, VAPOR

American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corporation, New York
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, WATER

American Radiator Co., Buffalo, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Grinnell Co., Providence, R. I.
Hornung, J. C., Chicago, Ill.
Mueller Co., Decatur, Ill.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.

HUMIDIFIERS

Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
General Air Filters Corp., New York.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Regulator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

HUMIDITY CONTROL

Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Carrier Engineering Corp., Newark, N. J.
Foxboro Co., Inc., The, Foxboro, Mass.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

INSTRUMENTS, ELECTRIC MEASURING

Bristol Co., The, Waterbury, Conn.

INSTRUMENTS, INDICATING AND RECORDING

Bristol Co., The, Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

INSULATION, BOILER, PIPE, ETC.

(See Covering, Boiler, Pipe, etc.)

INSULATION, BUILDING

Celotex Co., Chicago, Ill.
Flax-li-num Insulating Co., St. Paul, Minn.
Insulite Co., Minneapolis, Minn.
Johns-Manville Corp., New York, N. Y.

KETTLES, COPPER

Badger & Sons Co., E. B., Boston, Mass.

MANOMETERS

Foxboro Co., Inc., The, Foxboro, Mass.

Badger Joints Mean *Uninterrupted* Service

...because, using no packing, they require no re-packing

THE steam heating company wants to have steam passing through the lines to the customers... without interruption.

The process company wants steam to pass through the lines to its tanks or vats... without interruption.

The power plant wants steam to pass through the lines to the turbo-generators or engines..without interruption.

Badger Self Equalizing Expansion Joints permit this. Requiring no packing when installed they require no packing while in service.

There is a Badger Joint for any pressure or expansion. Standard sizes range up to 30 inches.

E. B. BADGER & SONS COMPANY

67 Pitts Street, Boston, Mass.

Atlanta, Georgia, Red Rock Bldg.
Charlotte, N. C., 1408 Realty Bldg.
Chicago, Ill., 2831 South Parkway
Cleveland, Ohio, Guardian Bldg.
Cincinnati, Ohio, Union Trust Bldg.
Denver, Col., 414 W. Colfax Ave.
Detroit, Mich., 1728 Ford Bldg.
Houston, Tex., Sec. Nat. Bank Bldg.
Los Angeles, Cal., 517 Hollingsworth Building
Minneapolis, Minn., 716 Build. Exch.
Montreal, Que., Can. Cement Bldg.
New York City, 271 Madison Ave.
Philadelphia, Pa., 1500 Walnut St.
Pittsburgh, Pa., Union Trust Bldg.
Portland, Ore., 1000 Buyers Bldg.
Salt Lake City, Utah, Kearns Bldg.
San Francisco, Cal., Sharon Bldg.
Seattle, Wash., 415 Lenora Street
St. Louis, Mo., 3605 Laclede Ave.
Syracuse, N.Y., 404 S. Clinton St.

MECHANICAL DRAFT APPLIANCES
(See Draft Appliances, Mechanical)

METALS, THERMOSTATIC
Chace Valve Co., W. M., Detroit, Mich.

METERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.

METERS, FEED WATER
Central Station Steam Co., Detroit, Mich.

METERS, PITOT TUBE
Buffalo Forge Co., Buffalo, N. Y.

METERS, STEAM
American District Steam Co., North Tonawanda, N. Y.

METERS, WATER, GAS, OIL & AIR
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

MOTORS (ELECTRIC)
Baldor Electric Co., St. Louis, Mo.
Century Electric Co., St. Louis, Mo.
Emerson Electric Mfg. Co., St. Louis, Mo.
Janette Mfg. Co., Chicago, Ill.
Ohio Electric & Controller Co., Cleveland, Ohio.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

NOZZLES, ACID RESISTING
Duriron Co., Inc., The, Dayton, O.

NOZZLES, SPRAY
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Dunham Co., C. A., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

OIL BURNERS
Electrol Inc., St. Louis, Mo.
Johnson Co., S. T., Oakland, Cal.
McIlvaine Burner Corp., Chicago, Ill.
Nu Way Corp., Rock Island, Ill.
Silent Automatic Corp., Detroit, Mich.

OIL BURNER EQUIPMENT
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Hornung, J. C., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Johnston Brothers, Inc., Ferrysburg, Mich.
W. W. Nugent & Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.

OIL BURNER IGNITION AND CONTROL EQUIPMENT
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Penn Electric Switch Co., Des Moines, Iowa.
Temperature Control Co., Chicago, Ill.
Time-O-Stat Controls Co., Elkhart, Ind.

OZONE APPARATUS
United States Ozone Co. of America, Scottdale, Pa.

PIPE, ACID-RESISTING
Duriron Co., Inc., The, Dayton, O.

PIPE BENDING
Badger & Sons Co., E. B., Boston, Mass.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Walworth Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING (WOOD)
American District Steam Co., North Tonawanda, N. Y.

PIPE, CAST-IRON
American Radiator Co., New York.

PIPE HANGERS
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Walworth Co., New York.

PIPE LIFTING MACHINES
Giant Twin Lift Co., Denver, Colo.

PIPE THREADING & CUTTING MACHINES
Crane Co., Chicago, Ill.

PIPE, STEEL
Crane Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.

PRESSURE REDUCING VALVES
(See Regulators, Pressure).

PULLEYS, VARIABLE SPEED

PUMPS, ACID RESISTING
Duriron Co., Inc., The, Dayton, O.

PUMPS, CENTRIFUGAL
American Steam Pump Co., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foster Wheeler Corp., New York.
Nash Engineering Co., So. Norwalk, Conn.

PUMPS, CENTRIFUGAL, VACUUM HEATING
Ames Pump Co., New York.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago, Ill.

PUMPS, CONDENSATION
Ames Pump Co., New York.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Eagan & Co., Walter H., Philadelphia, Pa.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.

PUMPS, OIL
Janette Mfg. Co., Chicago, Ill.
Nugent & Co., W. W., Chicago, Ill.

PUMPS, RECIPROCATING STEAM
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.

PUMPS, SUMP
Chicago Pump Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.

PUMPS, TURBINE
Ames Pump Co., New York.
Foster Wheeler Corp., New York.
Nash Engineering Co., So. Norwalk, Conn.

PUMPS, VACUUM
Ames Pump Co., New York.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foster Wheeler Corp., New York.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago, Ill.

PUNCHING AND SHEARING MACHINES
Smith & Sons Co., David H., Brooklyn, N. Y.

RADIATION, LIGHT WEIGHT, NON FERROUS
American Radiator Co., New York.
McQuay Radiator Co., Chicago, Ill.
The Herman Nelson Corp., Moline, Ill.
Rome Brass Radiator Corp., New York.
Rome Turney Radiator Co., Rome, N. Y.
Thermal Units Co., Chicago, Ill.
Winchester Repeating Arms Co., New Haven, Conn.
Young Radiator Co., Racine, Wis.

RADIATOR ENCLOSURES AND SHIELDS
McQuay Radiator Corp., Chicago, Ill.
Schleicher Inc., Gary, Ind.

RADIATOR HANGERS
American Radiator Co., Buffalo, N. Y.
Grinnell Co., Providence, R. I.
Hartmann Co., Charles, Brooklyn, N. Y.
Healy-Ruff Co., St. Paul, Minn.
Kewanee Boiler Corp., Kewanee, Ill.
McAlear Mfg. Co., Chicago, Ill.

RADIATOR TUBES, COPPER
Wolverine Tube Co., Detroit, Mich.

RADIATORS, CABINET AND CONCEALED
Air-Way Electric Appliance Corp., Toledo, Ohio.
Fintube Radiator Co., Long Island City, N. Y.
Heintz Mfg. Co., Philadelphia, Pa.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
Rome Brass Radiator Corp., New York.
Thermal Units Co., Chicago, Ill.
Young Radiator Co., Racine, Wis.

RADIATORS, CAST-IRON
American Radiator Co., Buffalo, N. Y.
Burnham Boiler Corp., Irvington, N. Y.
Crane Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Modine Mfg. Co., Racine, Wis.
National Radiator Corp., Johnstown, Pa.
Nelson Corp., Herman, The, Moline, Ill.
Page Boiler Co., Wm. H., New York.

RADIATORS, VERTICAL FIN
Wolverine Tube Co., Detroit, Mich.

RECEIVERS, AIR
Brownell Co., The, Dayton, Ohio.
Frost Mfg. Co., Galesburg, Ill.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

RECEIVERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

REFRIGERATING APPARATUS
Vilter Mfg. Co., Milwaukee, Wis.

REGULATORS, BOILER-FEED
Atlas Valve Co., Newark, N. J.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, DAMPER
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Atlas Valve Co., Newark, N. J.
Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
The Stack Heater Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, GAS
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

REGULATORS, PRESSURE
American District Steam Co., North Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kainer & Company, Chicago, Ill.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Regulator Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, TEMPERATURE
(See Temperature Control)

REGULATOR, WATER
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

SEPARATORS, OIL
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Webster & Co., Warren, Camden, N. J

SEPARATORS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Swartwout Co., Cleveland, Ohio.
Webster & Co., Warren, Camden, N. J

SPRAY COOLING SYSTEMS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

SPRAY NOZZLES
(See Nozzles, Spray)

STERILIZER, WATER
U. S. Ozone Corp., Scottdale, Penn.

STOKERS, MECHANICAL
Auto-Coala Corp., New York, N. Y.
Brownell Co., Dayton, Ohio.
Detroit Stoker Co., Detroit, Mich.
Domestic Stoker Co., New York.
Whiting Corp., Harvey, Ill.

STRAINERS, OIL
Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Nugent & Co., W. W., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, WATER
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

TANKS, COPPER
Badger & Sons Co., E. B., Boston, Mass.

TEMPERATURE CONTROL
American Radiator Co., Buffalo, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Carrier Engineering Corp., Newark, N. J.
Foxboro Co., Inc., The, Foxboro, Mass.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Des Moines,
Raymond, F. I., Chicago, Ill.
Sarco Co., Inc., New York.
Sheer Co., H. M., Quincy, Ill.
The Stack Heater Co., Boston, Mass.
Stat-Amatic Instrument & Appliance Co., Hartford, Conn.
Sterling Engineering Co., Milwaukee, Wis.
Time-O-Stat Controls Co., Elkhart, Ind.
Watts Regulator Co., Lawrence, Mass.

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Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Powers Regulator Co., Chicago, Ill.

THERMOSTATIC METAL

W. M. Chace Valve Co., Detroit, Mich.

THERMOSTATS

Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Stat-Amatic Instrument & Appliance Co., Hartford, Conn.
Time-O-Stat Controls Co., Elkhart, Ind.

TRAPS, BUCKET

Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Swartwout Co., Cleveland, Ohio.

TRAPS, FLOAT

Crane Co., Chicago, Ill.
Heat Transfer Products, Inc., New York, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Swartwout Co., Cleveland, Ohio.

TRAPS, FLOAT & THERMOSTATIC

Dunham Co., C. A., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York, N. Y.

TRAPS, INVERTED BUCKET (STEAM AND AIR)

Armstrong Machine Wks., Three Rivers, Mich.

TRAPS, LIFTING

Crane Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.
Swartwout Co., Cleveland, Ohio.

TRAPS, RADIATOR

American District Steam Co., North Tonawanda, N. Y.
Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville Corp., New York, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York City.
Webster & Co., Warren, Camden, N. J.

TRAPS, RETURN

American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Swartwout Co., Cleveland, Ohio.
Webster & Co., Warren, Camden, N. J.

TRAPS, STEAM

American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Connor Co., Inc., The W. B., New York.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Dunham Co., C. A., Chicago, Ill.
Heat Transfer Products, Inc., New York, N. Y.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill
Sarco Co., Inc., New York.

TRAPS, VACUUM

Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Wm. S. Haines & Co., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Swartwout Co., Cleveland, Ohio.
Webster & Co., Warren, Camden, N. J.

TUBING, COPPER AND BRASS

Crane Co., Chicago, Ill.

TUBING, SEAMLESS, COPPER, BRASS AND ALUMINUM

Wolverine Tube Co., Detroit, Mich.

TURBINES, STEAM

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

TURBO-BLOWERS

Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

UNIT HEATERS

(See Heaters, Unit)

VACUUM CLEANING APPARATUS

American Radiator Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VALVES, ACID RESISTING

Crane Co., Chicago, Ill.
Duriron Co., Inc., The, Dayton, O.

VALVES, AIR, AUTOMATIC

American Radiator Co., Buffalo, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

VALVES, AIR RELIEF

American Radiator Co., Buffalo, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Gorton Heating Corp., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
The Stack Heater Co., Boston, Mass.

VALVES, BACK PRESSURE

Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, BALANCED

Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

VALVES, BLOW-OFF

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Lytton Mfg. Corp., Franklin, Va.
National Radiator Corp., Johnstown, Pa.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Walworth Co., New York.

VALVES, CHECK

Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, DIFFERENTIAL RELIEF, GAS

Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

VALVES, FLOAT

Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Time-O-Stat Controls Co., Elkhart, Ind.
Watts Regulator Co., Lawrence, Mass.

VALVES, GATE

American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
Walworth Co., New York.

VALVES, GLOBE, ANGLE & CROSS

Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, HYDRAULIC-OPERATING

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
Walworth Co., New York.

VALVES, MAGNETIC

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Time-O-Stat Controls Co., Elkhart, Ind.

VALVES, NON BY-PASS

The Stack Heater Co., Boston, Mass.

VALVES, NON-RETURN

Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Walworth Co., New York.

VALVES, RADIATOR

American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York.
Walworth Co., New York.
Webster & Co., Warren, Camden, N. J.

VALVES, PRESSURE REDUCING

(See Regulators, Pressure)

VALVES, REGULATING

Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kainer & Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Walworth Co., New York.

VALVES, RELIEF (WATER)

Crane Co., Chicago, Ill.
Kainer & Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Radiator Corp., Johnstown, Pa.
The Stack Heater Co., Boston, Mass.

VALVES, SAFETY

American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
National Radiator Corp., Johnstown, Pa
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
The Stack Heater Co., Boston, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.
Walworth Co., New York.

VALVES, STOP AND CHECK

(See Valves, Non-Return).

VALVES, VACUUM RELIEF

The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

VENTILATING SYSTEMS

American Radiator Co., Buffalo, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
National Regulator Co., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

VENTILATING SYSTEMS, ACID

Duriron Co., Inc., The, Dayton, O.

VENTILATORS

Bayley Blower Co., Milwaukee, Wis.
Midwest Mfg. Co., Bradford, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VENTILATORS, FLOOR

Aeolus Dickinson, Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Knowles Mushroom Ventilator Co., New York.
Ventilating Products Co., Chicago, Ill

VENTILATORS, ROOF

Aeolus Dickinson, Chicago, Ill.

VENTILATORS, UNIT

Nelson Corp., Herman, The, Moline, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

WATER STERILIZERS

WRENCHES, STILLSON

Walworth Co., New York.

ZONE HEATING SYSTEMS

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Webster Talmadge, New York.

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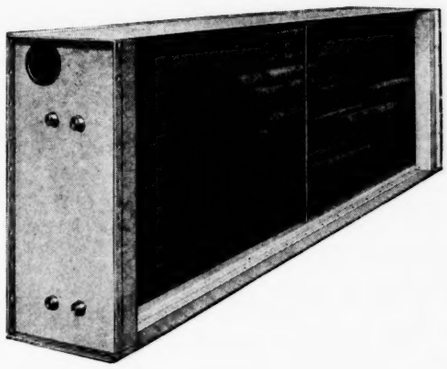

We will be glad to send you complete information and engineering data.

AMERICAN RADIATOR COMPANY

816 So. Michigan Avenue, Chicago 40 West 40th Street, New York

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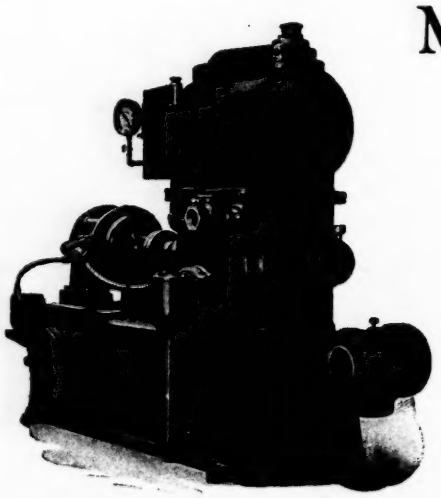
SKIDMORE VACUUM PUMPS
Stand for
MAINTAINED EFFICIENCY



Skidmore Automatic Vacuum Pump

SKIDMORE VACUUM PUMPS do not depend on close clearances to maintain their efficiency — close clearances mean wear — wear means loss of efficiency — eliminate close clearances and eliminate wear — use a SKIDMORE on your next job and your vacuum pump worries are over.

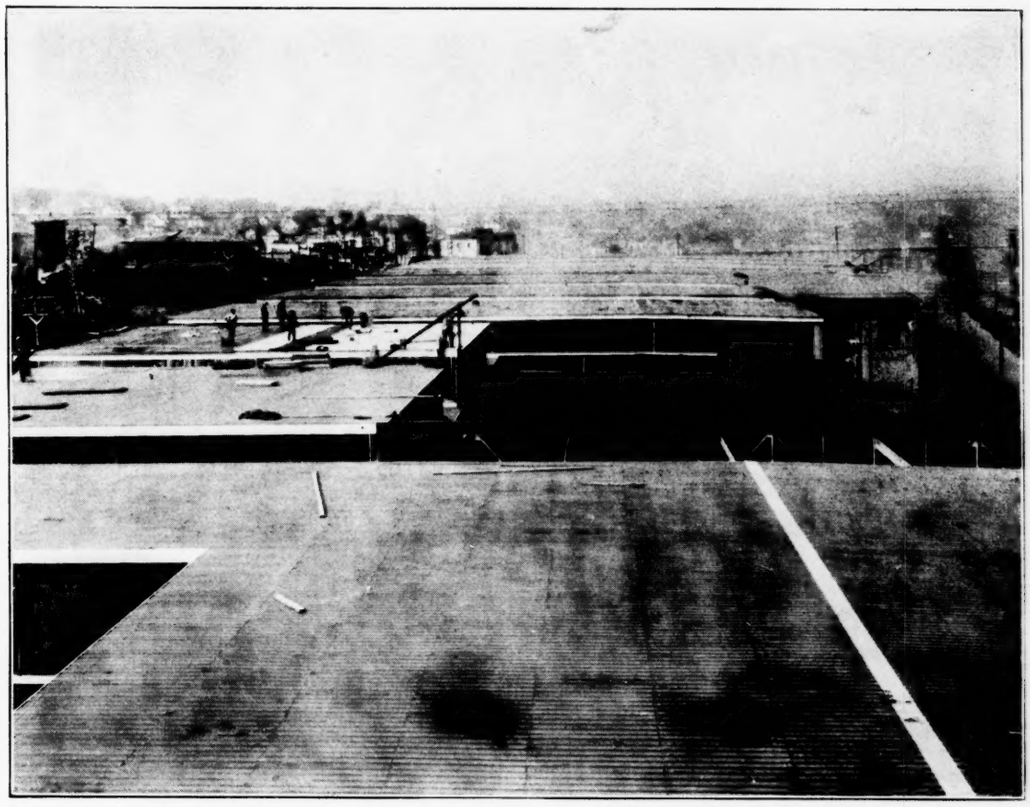
Write for Bulletin No. 6

SKIDMORE CORPORATION, CHICAGO

Office and Factory—1535 Dayton St.

Representatives in Principal Cities

Canadian Representative: Darling Bros., Ltd., Montreal



The Sheffield Steel Company Plant Kansas City, Missouri

Here 145,000 square feet of Celotex Roof Insulation Board are being laid over a steel deck manufactured by the owners. Sellers & Marquis Roofing Co., Roofing Contractors.

For high insulating efficiency and better ventilation specify Celotex Roof Insulation Board

HEATING engineers have proved it is easier to maintain even working temperatures under Celotex insulated roofs.

Buildings can be adequately heated with smaller heating plants and considerably less radiation.

Savings in fuel costs through a period of years reach a surprisingly large total.

Celotex Roof Insulation Board shuts out the sweltering summer heat . . . improves ventilation . . . provides better working conditions and speeds up production.

Celotex Roof Insulation prevents condensation of moisture—a costly evil in many industrial buildings. Then too it reduces the hazard of contraction and expansion of roof decks.

In hundreds of plants, Celotex Roof Insulation Board has been specified and used . . . not only because of its low thermal conductivity, but because of its low cost of application.

It is quickly and easily applied on new or old buildings . . . over wood, concrete, metal, or unit tile constructed roof-decks. Or it can be laid right over the old built-up roof covering and then covered with new built-up roofing.

Celotex Roof Insulation Board measures 2′ by 5′ with a thickness of approximately ½″ . . . also furnished in laminated multiples of from 2 to 8 plies, thus permitting the application of several layers in one operation.

Write for our folder *Dividends from Proper Roof Protection,* containing carefully tabulated data on the actual savings in fuel and radiation obtained with Celotex Roof Insulation Board.

Your problems are our problems. Our engineers are competent and ready to help you solve them.

The word CELOTEX (Reg. U. S. Pat. Off.) is the trademark of and indicates manufacture by The Celotex Company Chicago, Ill.

CELOTEX
BRAND
INSULATING CANE BOARD
ROOF INSULATION

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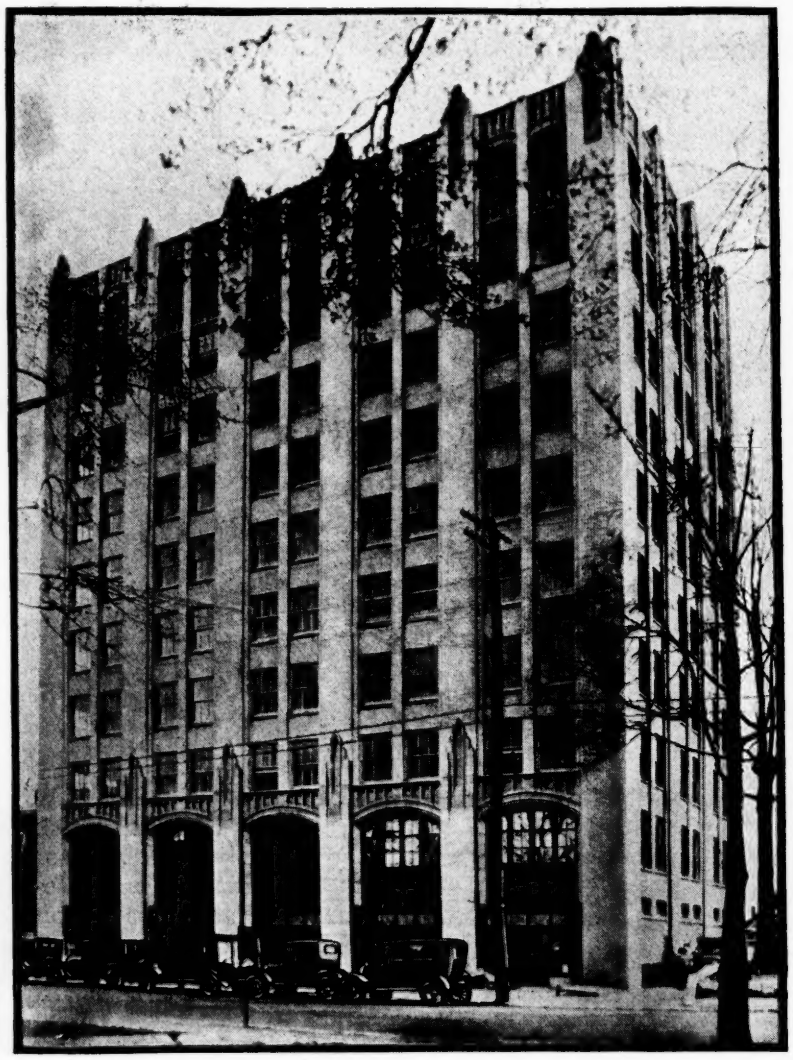
919 North Michigan Avenue
Chicago, Illinois
In Canada:
Alexander Murray & Co., Ltd., Montreal
***Mills:* New Orleans, Louisiana**
Branch Sales Offices in many principal cities
(See telephone books for addresses)
Sales Distributors throughout the World

MARSH

aids warm southern hospitality

Where climate is generally mild, but occasionally severe



To assure comfort and efficiency the new Medical Arts Building at Chattanooga, Tennessee, is equipped with Marsh Vacuum Heating System. R. H. Hunt, architect; W. S. Adams Co., heating contractor.

Marsh Heating Systems

enjoy deserved popularity.

Their accuracy and certainty of control is the direct result of 64 years of engineering genius and manufacturing skill.

The following are a few of the most recent Marsh installations in Tennessee:

Medical Arts Bldg., Chattanooga, Tenn.
Notre Dame School, Chattanooga, Tenn.
Chattanooga Municipal Airport, Chattanooga, Tenn.
Volunteer Life Bldg., Chattanooga, Tenn.
Life & Casualty Ins. Co. Bldg., Nashville, Tenn.
Protestant Hospital, Nashville, Tenn.
State Training & Agricultural School, Nashville, Tenn.
Geo. Cole Motor Co., Nashville, Tenn.
Lebanon Woolen Mills, Lebanon, Tenn.
Columbia Mutual Tower Bldg., Memphis, Tenn.

For uniform heating and fuel economy Marsh Heating Systems and Specialties predominate.

Architects and contractors are invited to send for Marsh bulletins and to make use of Marsh engineering service.

Increased activity in rapidly expanding markets has made it necessary to increase the number of our representatives. Sales engineers, experienced in heating equipment or similar lines, are invited to write. If your territory is open, this may mean a valuable connection.

JAS. P. MARSH & CO.

Division of General Instrument Corporation

2073 Southport Avenue, CHICAGO, ILLINOIS · 551 Fifth Avenue, NEW YORK CITY · Bond Building, WASHINGTON, D. C.
318 Volunteer Life Bldg., CHATTANOOGA, TENN. · 117 Fifth Avenue North, NASHVILLE, TENN. · 242 Madison Avenue, MEMPHIS, TENN.

Other offices in principal cities

HEATING AND VENTILATING

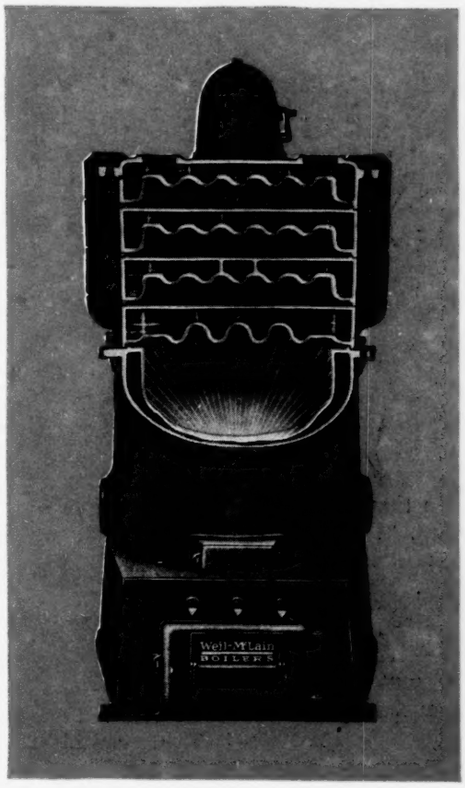
FAMOUS FIGHTERS

MUSKELLUNGE

(American Game Fish)

The "musky" or great pike is one of the highest prizes for sportsmen. Because he is such a superb fighter—swift, strong and fierce—the angler who vanquishes him must also be a great fighter. The muskellunge is a magnificent fish. He is the largest of his family and most to be feared as a predatory force in American fresh waters. He ranges from 2½ to 5½ feet in length and often weighs up to 100 lbs. As is the case with all famous fighters, the superiority of the "musky" rests upon certain fighting qualities. Without these he would be no better than any other fish.

Why Weil-McLain Boilers *are famous fighters*



Weil-McLain Boilers have fighting features, too! These features not only fight fuel and heat waste for home owners, but they are easily demonstrated. They are good reasons why Weil-McLain Boilers are so easy to sell.

Fuel-saving corrugations like this ∿∿∿

Weil-McLain Round Boilers, for example, deliver more heat and save fuel, because all vital heat-absorbing surfaces are corrugated like this ∿∿∿ instead of flat like this ———. You can readily see that corrugations crowd 30 to 40 per cent more heating surface into the same space.

Balanced back-and-forth fire travel

More heat is actually utilized in Weil-McLain Boilers because Weil-McLain fire travel is not only back and forth but it is *balanced*. Variations in the rate of operation, due to varying heat demands, do not alter the long, balanced, back-and-forth flow of gases through the flues.

In the complete line of Weil-McLain Boilers you will find scientific principles of design that enable these boilers to fight fuel waste and deliver more heat. The line includes Round Type, Jacketed, Square, Self-feed and Smokeless Boilers. Also Weil-McLain "Cameo" Radiators.

WEIL-McLAIN COMPANY, General Office: Chicago
Boiler Plant and Offices: Michigan City, Ind.
Radiator Plant and Offices: Erie, Pa.

Jobbing distributors with local stocks in most jobbing centers

Weil-McLain
SCIENTIFIC COMBUSTION
BOILERS
fight fuel waste and deliver more heat

© 1930, W-McL.

"And...I must have a temperature in *that* room of 80°

the building..

A PHYSICIAN'S RESIDENCE ... AND PRIVATE HOSPITAL

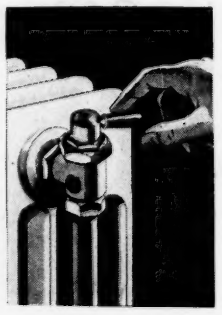
"In that room," explained the physician, "I must be able to maintain a temperature throughout the day of 80°. The rest of the time it need not be heated to more than 65° to 70°. What do you recommend?"

A difficult problem? Not at all—not with Hoffman Controlled Heat. For Hoffman Controlled Heat can be balanced up so accurately that it will provide the temperature desired for every individual room — and at the same time give the user finger touch control of the heat output of each radiator.

No other heating system is so flexible and so easy to balance up as Hoffman Controlled Heat. By a simple adjustment of the radiator modulating valves, the contractor can distribute heat uniformly throughout the building—speed up the heating of certain radiators — or retard the heating of others. There is no guesswork about the adjustment, for it is external, visible and made after the system is installed and operating. Nothing is taken apart and the only tool needed is a wrench.

Hoffman Controlled Heat is adapted for all types of buildings from a modest residence to a giant skyscraper and may be installed with any standard boiler and radiators. For full information write Hoffman Specialty Company, Inc., Dept. C-61, Waterbury, Conn.

The Hoffman No. 7 Valve, because of its dual adjustment enables the contractor scientifically to balance up the system, and the user to control the amount of steam entering the radiator.



HOFFMAN CONTROLLED HEAT

HOFFMAN CONTROLLED HEAT

Consists of These Controlling Devices

No. 7 Valve. Controls — at the touch of a finger — the heat output of each radiator.

No. 8 Return Line Valve. Controls—automatically—the flow of condensation and air from each radiator.

Differential Loop. Controls—automatically — and protects the boiler water line.

Damper Regulator. Controls—automatically—the combustion of fuel and the production of steam in accordance with demand.

Kompo Gage. Registers pressure or vacuum under which the system operates.